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HAY'S
SELF-TESTING ARITHMETIC.
—
PRICE EIGHTPENCE.

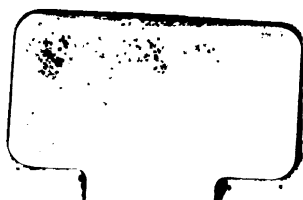
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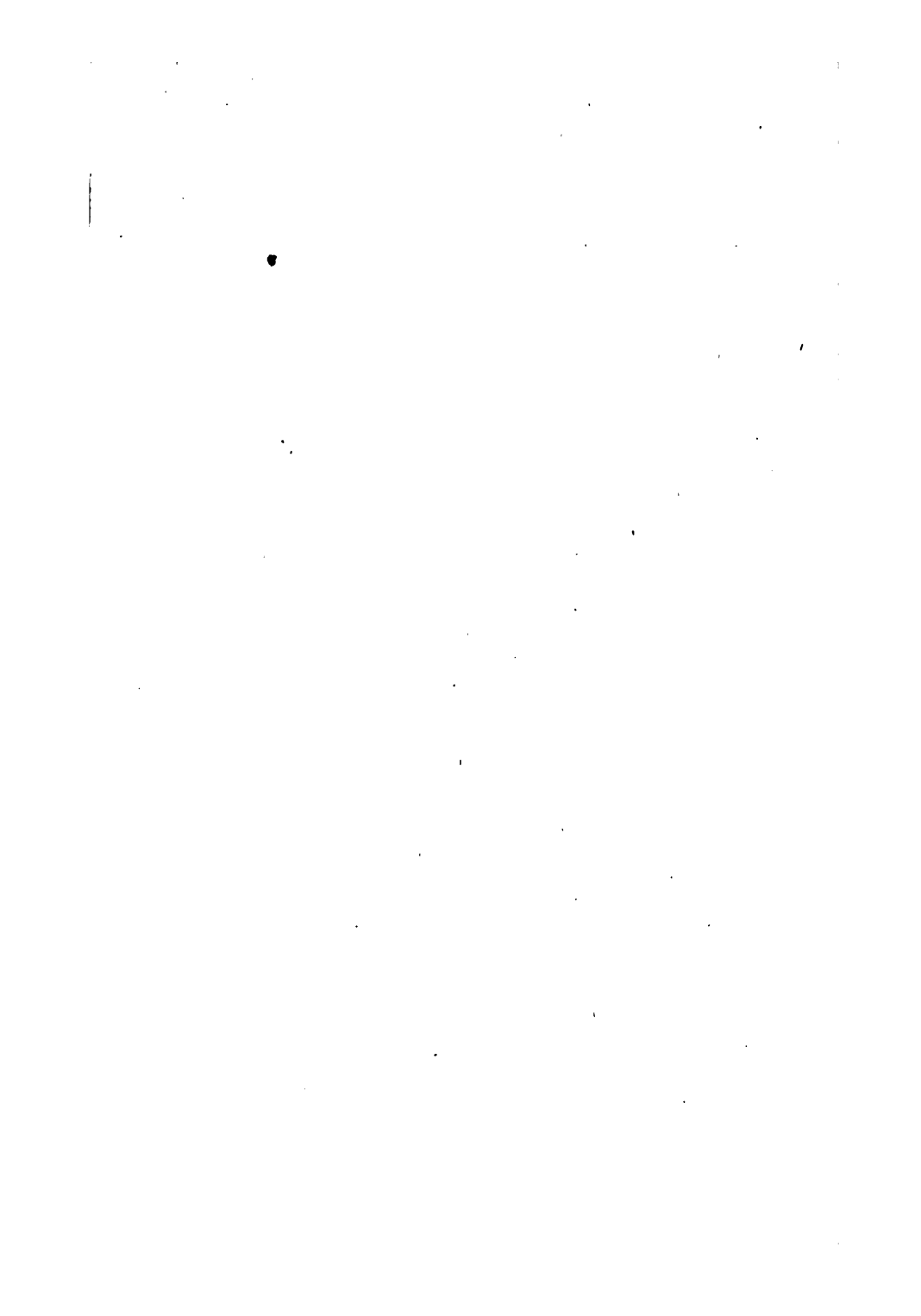
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THE
SELF-TESTING ARITHMETIC,
ON A NEW PLAN, SIMPLE AND SCIENTIFIC,
CONTAINING THE
Largest Number of Exercises ever Published,
AND
METHODS BY WHICH THE TEACHER IS ENABLED TO CONSTRUCT
AN INFINITE NUMBER OF SELF-TESTING EXERCISES
IN THE SIMPLE AND COMPOUND RULES AND IN PRACTICE.

By JOHN HAY, F.E.I.S.,
RECTOR OF MUSSELBURGH GRAMMAR SCHOOL;
AND FORMERLY OF DUMBARTON BURGH ACADEMY.

GLASGOW:
WILLIAM HAMILTON, PRINTER AND PUBLISHER, 33 BATH STREET;
JOHN MENZIES AND OLIVER & BOYD, EDINBURGH; JOHN HEYWOOD,
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1863.



PREFACE.

THE elementary arithmetics at present in use in schools may be classed under three heads: *first*, those which contain answers to the exercises; *second*, those without answers; and *third*, those whose exercises are so constructed as to enable the teacher to test the answers. The objections to the first two are sufficiently illustrated by the many attempts to produce books of the third class, and by the evident satisfaction with which the announcement of every successive book is received by the teaching profession—yet, how few of these are now in general use! After trial they have been discarded as useless, either from the principle, if arbitrary and factitious, being easily detected by the pupil; or, if scientific, from its application requiring too much time and labour on the part of the Teacher. In both cases, too, the exercises have generally been limited in their range, and very unlike the requirements of actual business. The difficulty of constructing self-testing exercises entirely free from objections can hardly be over-stated: but from the present attempt having met with the cordial approbation of high educational authorities, the author ventures to hope that it will be found free from those just enumerated. The principle may be *explained* to the pupil without enabling him to “force” the answer, and by it his work can be tested at a glance. The only case in which the principle of the answer is not given in the text is in Addition, (Simple and Compound,) but the Teacher by taking unity for the first line, and proceeding as there explained will at once discover the multiplier for any number of lines, and the ratio of the third line to the sum of six lines, of the fourth line to the sum of seven lines, of the sixth line to the sum of nine lines, of the seventh line to the sum of ten lines, &c.

Those who agree with the author in thinking that practice in adding columns of money &c., much larger than those given in any School Arithmetic, is a useful exercise for senior pupils preparing for commercial situations, will at once appreciate the importance of the method in the text, and the reason for thus explaining the principle of the answers.

The exercises in application of the rules will be found no less suited for use in the class-room than for preparation for the work of the counting-house.

MUSSELBROUGH GRAMMAR SCHOOL,
July, 1863.

TABLE OF WEIGHTS & MEASURES.

1.—Troy Weight.

24 grains	= 1 pennyweight. (dwt.)
20 pennyweights	= 1 ounce (oz.)
12 ounces	= 1 pound (lb.)
5760 grains	= 1 pound.

2.—Avoirdupois Weight.

16 drams	= 1 ounce (oz.)
16 ounces	= 1 pound (lb.)
28 pounds	= 1 quarter (qr.)
4 quarters or 112 lb.	= 1 hundredweight (cwt.)
20 hundredweights	= 1 ton (t.)

3.—Apothecaries Weight.

20 grains	= 1 scruple (scr.)
3 scruples	= 1 dram (dr.)
8 drams	= 1 ounce (oz.)
12 ounces	= 1 pound (lb.)

4.—Measure of Capacity.

4 gills	= 1 pint (pt.)
2 pints	= 1 quart (qt.)
4 quarts or 8 pints	= 1 gallon (gal.)
63 gallons	= 1 hogshead (hhd.)
2 gallons	= 1 peck (pk.)
4 pecks	= 1 bushel (bu.)
8 bushels	= 1 quarter (qr.)

5.—Lineal Measure.

12 lines	— 1 inch (in.)
12 inches	— 1 foot (ft.)
3 feet	— 1 yard (yd.)
5½ yards	— 1 pole (po.)
40 poles	— 1 furlong (fur.)
8 furlongs or 1760 yards	— 1 mile (m.)

8.—Cloth Measure.

2½ inches	— 1 nail (nl.)
4 nails	— 1 quarter (qr.)
4 quarters	— 1 yard (yd.)
5 quarters	— 1 English ell (E. ell.)
3 quarters	— 1 Flemish ell (Flem. ell.)
6 quarters	— 1 French ell (Fr. ell.)

6.—Square Measure.

144 square inches	— 1 square foot (sq. ft.)
9 square feet	— 1 square yard (sq. yd.)
80½ square yards	— 1 square pole (sq. po.)
40 poles	— 1 rood (ro.)
4 roods	— 1 acre (ac.)

9.—Time.

60 seconds	— 1 minute (min.)
60 minutes	— 1 hour (ho.)
24 hours	— 1 day (da.)
365½ days	— 1 Julian year.
366 days	— 1 leap year.
365 days, 5 hours, 48 minutes, 48 seconds	— 1 solar year.

7.—Cubic or Solid Measure.

1728 cubic inches	— 1 cubic foot (c. ft.)
27 cubic feet	— 1 cubic yard (c. yd.)
42 cubic feet	— 1 ton of shipping.
40 cubic feet of rough, or 50 cubic feet of hewn timber	— 1 ton or load.

Thirty days are in September,
April, June, and dull November,
All the rest have thirty-one,
But February's month alone,
Which has but twenty-eight days clear,
And twenty-nine in each leap year.

MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160
9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	162	171	180
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	187	198	209	220
12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240
13	26	39	52	65	78	91	104	117	130	143	156	169	182	195	208	221	234	247	260
14	28	42	56	70	84	98	112	126	140	154	168	182	196	210	224	238	252	266	280
15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300
16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340
18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360
19	38	57	76	95	114	133	152	171	190	209	228	247	266	285	304	323	342	361	380
20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400

(ser)
dr.
(us)
(p)

(t.)
(seal.)
ad (2nd)
pk.
(in)
22 (40)

FORMS OF BILLS, RECEIPTS, &c.

INLAND BILL.

GLASGOW, *June 27th*. 1863.

£100.

Three months after date, pay to me or order, at the Union Bank of Scotland here, the sum of one hundred pounds sterling, for value received.

CHARLES DONALDSON
ALEXANDER BROWN.

To Mr. ALEXANDER BROWN, }
Merchant, Glasgow. }

FOREIGN BILL

DUNEDIN, OTAGO, N.Z.,
April 4th. 1863.

£1242 16s. 8d.

Two months after sight of this my first of exchange, (second and third of the same tenor and date unpaid) pay to the order of Messrs, Herbert, Haynes, and Hay, one thousand two hundred and forty-two pounds sixteen shillings and eightpence sterling, value of Edward Fotheringham, Esq., and place it to account of, as per advice from

GEORGE HENDERSON.
Accepted 10th. June, 1863.
JAMES KERR.

To Mr. JAMES KERR, }
Merchant, London. }

A PROMISSORY NOTE.

EDINBURGH, *July 1st*. 1863.

£24 10s. 6d.

Sixty days after date, I promise to pay to Mr. Matthew Norris or order, at my office here, the sum of twenty-four pounds ten shillings and sixpence sterling, value received.

OLIVER PATTIESON.

RECEIPTS.

DUMBARTON, *June 29th*. 1863.

£27 5s. 4d.

Received from Quintin Robertson, Esq., the sum of twenty-seven pounds five shillings and fourpence, in full of his account to this date.

SAMUEL THOMSON.

MUSSELBURGH, *July 2nd*. 1863.

£148 10s.

Received from Mr. William Watson, the sum of one hundred and forty-eight pounds ten shillings sterling, in full for leather as per annexed account.

ADAM BERTEAM.

EDINBURGH, *November 11th*. 1862.

£80.

Received from Crawford Dunn, Esq., the sum of sixty pounds sterling, being the half-year's rent, ending at Martinmas, of that house, occupied by him, No. 391 Queen St., Edinburgh.

RICHARD TURNBULL.

THE SELF-TESTING ARITHMETIC.

NOTATION.

I.

TABLE—To be committed to memory.

Roman.	Arabic.	Roman.	Arabic.	Roman.	Arabic.	Roman.	Arabic.
I.	= 1	XI.	= 11	XXX.	= 30	CD.	= 400
II.	" 2	XII.	" 12	XL.	" 40	D.	" 500
III.	" 3	XIII.	" 13	L.	" 50	DC.	" 600
IV.	" 4	XIV.	" 14	LX.	" 60	DCC.	" 700
V.	" 5	XV.	" 15	LXX.	" 70	DCCC.	" 800
VI.	" 6	XVI.	" 16	LXXX.	" 80	CM.	" 900
VII.	" 7	XVII.	" 17	XC.	" 90	M.	" 1000
VIII.	" 8	XVIII.	" 18	C.	" 100	MD.	" 1500
IX.	" 9	XIX.	" 19	CC.	" 200	MDCCCLXIII.	
X.	" 10	XX.	" 20	CCC.	" 300		= 1863

EXERCISES.

Express in Roman notation, and then in Arabic notation, the following numbers:—

- (1) One, seventeen, eleven, twenty, two, nine.
- (2) Three, fourteen, thirty-three, forty-seven, six.
- (3) Forty-five, sixty-four, forty-six, seventy-two.
- (4) Twenty-seven, ninety, fifty, sixty-one, sixteen.
- (5) Seventy-four, forty-seven, seventy-nine, sixty.
- (6) One hundred, four hundred, nine hundred, seven hundred.
- (7) Three hundred, eight hundred and fifty, six hundred and ninety.
- (8) Five hundred and twenty, two hundred and forty, eighty-nine.
- (9) One hundred and thirty (and) four, two hundred and sixty (and) nine.
- (10) Three hundred and ninety (and) five, three hundred and fifty-nine.

II.

Write in Arabic notation, and put in the proper columns on your slate thus ruled and headed—

	Thousands.	Hundreds.	Tens.	Units
<i>Example</i> —Two thousand five hundred and sixty-nine,	2	5	6	9

- | | |
|--|---|
| (1) Four hundred and sixty-four. | (18) Twenty-seven thousand and five. |
| (2) Six hundred and seventy-three. | (19) Forty-four thousand and forty-four. |
| (3) Eight hundred and ninety-nine. | (20) Sixty-eight thousand, three hundred and three. |
| (4) Six thousand, nine hundred and ninety-two. | (21) One score. |
| (5) Nine thousand, four hundred and forty-four. | (22) One dozen. |
| (6) Three thousand, five hundred and sixty-eight. | (23) Nine and twenty. |
| (7) Eight thousand. | (24) Seven hundred and thirty-six. |
| (8) Eight hundred. | (25) Three score and ten. |
| (9) Eighty. | (26) Two thousand, two hundred and twenty-two. |
| (10) Eight. | (27) Forty-four thousand, four hundred and forty-four. |
| (11) One thousand four hundred. | (28) Six hundred and sixty-six thousand, six hundred and sixty-six. |
| (12) Three thousand six hundred. | (29) Seven hundred and seventy-seven thousand, seven hundred and seventy. |
| (13) Nine thousand, nine hundred and one. | (30) Ninety-nine thousand, nine hundred and nineteen. |
| (14) Seventeen thousand, six hundred and thirty-seven. | |
| (15) Two thousand and forty-two. | |
| (16) Three thousand and ninety-nine. | |
| (17) Eight thousand and eighty-eight. | |

Write the following numbers:—

11	101	111	900	1234	87654	879080
234	342	432	990	5678	345678	9200301
871	589	985	909	25790	505050	9999999

SIMPLE ADDITION.

TABLE I.—For daily use in the class.

(1)	1	2	3	4	5	6	7	8	9
(2)	9	8	7	6	5	4	3	2	1
(3)	2	4	6	8	1	3	5	7	9
(4)	7	10	1	4	7	2	6	8	7
(5)	1	3	5	7	9	2	4	6	8
(6)	9	1	8	2	7	3	6	4	5

(1) Add 2, *viva voce*, to each of the figures in cols. 1, 2, 3, 4, 5—thus, 2 and 1 are 3, 2 and 2 are 4, 2 and 3 are 5, &c. (2) 2 and 9 are 11, 2 and 8 are 10, &c., and so with 3, 4, 5, 6.

(2) Add, *viva voce*, 3 to each of the figures in cols. 1, 2, 3, 4, 5, 6.

(3) Add, *viva voce*, 4, 5, &c., to each figure in each column.

(4) Add as before, naming aloud the result thus—col. 4, adding by 2. Results, 9, 12, 3, 6, &c.

(5) Take col. headed 1, going downwards, and add 7 to each figure. The results are 8, 16, 9, 14, &c.

TABLE II.—For daily use in the class.

1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9

Take a number and add to it successively all the digits in any column. *Example 1*—Take 8 and col. 4; the results are 12, 16, 20, 24, 28, 32, &c. *Example 2*—Take 3 and col. 9; results are 12, 21, 30, 39, &c.

This table may be used in a variety of ways. *Example*—Add col. 1 to col. 9, col. 2 to col. 8, 3 to 7, 4 to 6. Add col. 1 to col. 2, 4 to 5, 8 to 9, &c. Add diagonally 1, 1 2, 1 2 3, &c. Add together the alternate columns, 1, 3, 5, 7, &c. or 2, 4, 6, 8, &c.

Add any number—say 7, and the alternate columns together, thus—beginning with col. 1. The results are 8, 11, 16, 23, &c.

These preliminary exercises should be practised at least for ten minutes at the beginning of each arithmetical lesson, the class pointing to the figures with their pencils, and answering first simultaneously and then individually.

The following sums are to be worked first *viva voce* in the class and then on slates.

III.

$$\begin{array}{r} (1) \ 1234567891234 \\ \quad 222222202222 \\ \hline \end{array}$$

$$\begin{array}{r} (2) \ 22222222222 \\ \quad 61715246351 \\ \hline \end{array}$$

$$\begin{array}{r} (3) \ 234234234234567 \\ \quad 123453714565922 \\ \hline \end{array}$$

$$\begin{array}{r} (4) \ 345345345345481 \\ \quad 683352521414833 \\ \hline \end{array}$$

$$\begin{array}{r} (5) \ 6051423678094 \\ \quad 3333873221905 \\ \hline \end{array}$$

$$\begin{array}{r} (6) \ 802978654302244 \\ \quad 187020134134134 \\ \hline \end{array}$$

IV.

(1) 1	(2) 2	(3) 7	(4) 3	(5) 2	(6) 5	(7) 6	(8) 1	(9) 2	(10) 4	(11) 8	(12) 8
2	3	0	0	4	1	0	1	1	1	6	3
2	1	1	5	1	0	1	4	3	1	3	7
<u>4</u>	<u>2</u>	<u>1</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>1</u>	<u>3</u>	<u>2</u>	<u>3</u>	<u>2</u>	<u>4</u>

V.

(1) 24	(2) 36	(3) 47	(4) 95	(5) 86	(6) 53	(7) 40	(8) 89
<u>49</u>	<u>75</u>	<u>58</u>	<u>78</u>	<u>59</u>	<u>99</u>	<u>76</u>	<u>90</u>
(9) 1234567	(10) 123	(11) 357	(12) 579	(13) 747	(14) 909		
<u>1932322</u>	<u>679</u>	<u>298</u>	<u>319</u>	<u>558</u>	<u>111</u>		

VI.

(1) 1094	(2) 1379	(3) 1111	(4) 1404	(5) 7850	(6) 8034
<u>2689</u>	<u>1046</u>	<u>1909</u>	<u>1509</u>	<u>6032</u>	<u>9659</u>
(7) 9004	(8) 3033	(9) 3456	(10) 3257	(11) 4989	(12) 9999
<u>7899</u>	<u>7707</u>	<u>3089</u>	<u>6999</u>	<u>3707</u>	<u>8909</u>

VII.

(1) 1234	(2) 3456	(3) 5678	(4) 9013	(5) 8008	(6) 4444	(7) 3194	(8) 3499
5678	7890	9135	5791	7909	9898	2976	9999
<u>9012</u>	<u>1234</u>	<u>7901</u>	<u>3579</u>	<u>8097</u>	<u>5678</u>	<u>8888</u>	<u>8785</u>
(9) 5678	(10) 9035	(11) 6802	(12) 13579	(13) 86394	(14) 98967	(15) 123456	
9012	7891	4683	24680	78795	32579	789012	
3456	3579	5791	35704	63854	89898	345678	
<u>7891</u>	<u>1357</u>	<u>3579</u>	<u>28639</u>	<u>89863</u>	<u>78978</u>	<u>987654</u>	

Sections VI. and VII. to be used also as exercises on Numeration.

VIII.

(1) 2357	(2) 3468	(3) 4579	(4) 5681	(5) 6793	(6) 8907	(7) 9077	(8) 12345
2357	3468	4579	5681	6793	8907	9077	12345
4714	6936	9158	11362	13586	17814	18154	24690
7071	10404	13737	17043	20379	26721	27231	37035
<u>11785</u>	<u>17340</u>	<u>22895</u>	<u>28405</u>	<u>33965</u>	<u>44535</u>	<u>45385</u>	<u>61725</u>
(9) 67891	(10) 24681	(11) 35793	(12) 76543	(13) 84906	(14) 990791		
67891	24681	35793	76543	84906	990791		
135782	49362	71586	153086	169812	1981582		
203673	74043	107379	229629	254718	2972373		
<u>339455</u>	<u>123405</u>	<u>178965</u>	<u>382715</u>	<u>424530</u>	<u>4953955</u>		

In all the Exercises in Section VIII. the second line is a repetition of the first; the third is the sum of the second and first; the fourth, the sum of the third and second; and the fifth the sum of the fourth and third.

IX.

The following Exercises are to be worked, as in Section VIII., by a series of additions of the bottom line to the one immediately above it till the required number of rows have been written out, when the whole series of rows are to be summed up. Note—5 r means 5 rows, 6 r, 6 rows, &c.

Example—What is the sum of 3594 extended to 5 rows?

First row,	=	3594	
Second "	"	3594	= same as first row.
Third "	"	7188	" sum of second and first.
Fourth "	"	10782	" sum of third and second.
Fifth "	"	17970	" sum of fourth and third.

43128 " sum of all the rows.

5 r	5 r	5 r	5 r	5 r	5 r
(1) 35	(7) 104	(13) 381	(19) 859	(25) 1584	(31) 3359
(2) 53	(8) 123	(14) 474	(20) 989	(26) 2346	(32) 3681
(3) 74	(9) 159	(15) 487	(21) 1002	(27) 2587	(33) 3793
(4) 87	(10) 168	(16) 567	(22) 1136	(28) 2599	(34) 3847
(5) 98	(11) 235	(17) 678	(23) 1259	(29) 2607	(35) 3943
(6) 99	(12) 257	(18) 732	(24) 1463	(30) 2808	(36) 4637

5 r	5 r	5 r	5 r	5 r	5 r
(37) 5748	(41) 9134	(45) 9999	(49) 14567	(53) 46093	(57) 123456
(38) 6859	(42) 9257	(46) 11111	(50) 15678	(54) 57109	(58) 1234567
(39) 7961	(43) 9379	(47) 12345	(51) 24871	(55) 68354	(59) 12345678
(40) 8074	(44) 9598	(48) 13456	(52) 35982	(56) 12345	(60) 123456789

X.

6 r	6 r	6 r	6 r	6 r	6 r
(1) 23	(11) 123	(21) 1234	(31) 7657	(41) 79076	(51) 2371932
(2) 34	(12) 345	(22) 1324	(32) 7869	(42) 80987	(52) 3482043
(3) 45	(13) 567	(23) 1432	(33) 8807	(43) 91094	(53) 4593154
(4) 56	(14) 576	(24) 1546	(34) 8913	(44) 93939	(54) 5604265
(5) 67	(15) 657	(25) 1648	(35) 9876	(45) 98765	(55) 6715376
(6) 78	(16) 713	(26) 2354	(36) 23475	(46) 135791	(56) 12345678
(7) 89	(17) 729	(27) 3465	(37) 34586	(47) 246812	(57) 23579891
(8) 91	(18) 847	(28) 4576	(38) 45697	(48) 357983	(58) 34680927
(9) 96	(19) 898	(29) 5687	(39) 56708	(49) 468094	(59) 45791834
(10) 99	(20) 999	(30) 6798	(40) 67819	(50) 579195	(60) 56809699

XI.

7 r	7 r	7 r	7 r	7 r
(1) 365	(11) 7632	(21) 246801	(31) 7654321	(41) 2403578978
(2) 476	(12) 8743	(22) 357912	(32) 8765432	(42) 3514689089
(3) 587	(13) 9854	(23) 468057	(33) 9876543	(43) 4625791963
(4) 698	(14) 8989	(24) 579168	(34) 10987654	(44) 5719318659
(5) 709	(15) 9999	(25) 680979	(35) 21098765	(45) 6831144967
(6) 817	(16) 12345	(26) 678967	(36) 987654627	(46) 3713965493
(7) 928	(17) 23456	(27) 789078	(37) 998765738	(47) 8045687654
(8) 1246	(18) 34567	(28) 890789	(38) 999878887	(48) 9878789767
(9) 5639	(19) 45678	(29) 909897	(39) 909099098	(49) 90119198767
(10) 8426	(20) 56789	(30) 987988	(40) 919198199	(50) 98765432199

XII.

Shew that

(1) 47 8r = 19 8r + 28 8r	(7) 369 8r = 137 8r + 232 8r
(2) 59 8r „ 37 8r „ 22 8r	(8) 477 8r „ 256 8r „ 221 8r
(3) 75 8r „ 49 8r „ 26 8r	(9) 987 8r „ 396 8r „ 591 8r
(4) 89 8r „ 37 8r „ 52 8r	(10) 999 8r „ 407 8r „ 592 8r
(5) 124 8r „ 56 8r „ 68 8r	(11) 9134 7r „ 6789 7r „ 2345 7r
(6) 246 8r „ 121 8r „ 125 8r	(12) 18898 9r „ 9089 9r „ 9809 9r

XIII.

9 r	9 r	9 r	9 r	9 r	9 r	9 r
(1) 578	(4) 782	(7) 918	(10) 1428	(13) 5678	(16) 12784	(19) 17986
(2) 646	(5) 816	(8) 986	(11) 2618	(14) 5984	(17) 16592	(20) 23575
(3) 714	(6) 851	(9) 1122	(12) 4046	(15) 6766	(18) 16895	(21) 41956

9 r	9 r	9 r	9 r	9 r
(22) 42364	(27) 121686	(32) 2408359	(37) 38459763	(42) 71919365
(23) 42738	(28) 147798	(33) 1930826	(38) 49560874	(43) 123456789
(24) 61608	(29) 169694	(34) 2298294	(39) 50698396	(44) 246892468
(25) 87686	(30) 335818	(35) 2682634	(40) 67123914	(45) 987654321
(26) 101796	(31) 1175278	(36) 3029298	(41) 64823857	(46) 987077099

XIV.

10 r	10 r	10 r	10 r	10 r
(1) 143	(9) 8764	(17) 196418	(25) 8069098	(33) 960990989
(2) 232	(10) 10945	(18) 317824	(26) 27913845	(34) 9779797977
(3) 376	(11) 17711	(19) 539097	(27) 38095097	(35) 8791733938
(4) 609	(12) 29659	(20) 876099	(28) 57839239	(36) 135791098737
(5) 986	(13) 50876	(21) 1243693	(29) 68909876	(37) 246809109848
(6) 1596	(14) 89983	(22) 2354704	(30) 71803257	(38) 357910890959
(7) 2563	(15) 98765	(23) 3465819	(31) 987654321	(39) 466876367839
(8) 4181	(16) 121393	(24) 5709397	(32) 998091987	(40) 987603959885

XV.

The sum of a required number of lines added to the first line will be equal to the line that is *two* more than the required number of lines. Thus, let 11 be the required number of lines. The sum of eleven lines added to the first line will be equal to the thirteenth line. Let 15 be the required number of lines, the sum of fifteen lines added to the first line will be equal to the seven-teenth line, and so on.

Example—Find what is the sum of 379 extended to 11 r, and test the result by the thirteenth line.

379—1st line.

379

758

1137

1895

3032

4927

7959

12886

20845

33731

—

54576

87928 = sum of eleven lines.

379 = first line.

thirteenth line = 88307 88307 = line that is two more than the required number of lines, i.e., (11 + 2) 13th line.

Perform the operations indicated below, and test the results in the same way.

(1) 789 12r	(5) 339875 19r	(9) 7837837 22r	(13) 786098989 23r
(2) 986 13r	(6) 864387 19r	(10) 8303099 22r	(14) 9246325491 26r
(3) 1397 14r	(7) 963989 20r	(11) 9099089 21r	(15) 9377458507 27r
(4) 6296 15r	(8) 1359637 20r	(12) 70778761 21r	(16) 12135783193 27r

SIMPLE SUBTRACTION.

PRELIMINARY EXERCISES—To be solved orally by the class.

- (1) From 989896789867987989789678956789345678923456789
Take 612123541323431788777666655554444433333322222222

- (2) From 120 subtract two successively as far as possible: thus 120, 118, 116, &c.
 " 121 " " " 121, 119, 117, &c.
 " 120 " three " 120, 117, 115, &c.
 " 121 " " " 121, 118, 115, &c.
 " 120 } " four, five, six, seven, eight, and nine, in the same way.
 " 121 }
- (3) From 80108729887776666555554444433333322222222111111111
Take 2305028989789678956789456789345678923456789123456789

XVI.

- | | | | | | |
|--------------|----------|-----------|--------------|-----------------|-------------------|
| (1) From 242 | (5) 702 | (9) 1708 | (13) 52392 | (17) 98765432 | (21) 326934817642 |
| Take 121 | 351 | 854 | 26196 | 49382716 | 163467408821 |
| <hr/> | | | | | |
| (2) From 354 | (6) 878 | (10) 1774 | (14) 78074 | (18) 2345678912 | (22) 3057799840 |
| Take 178 | 394 | 887 | 39037 | 1172839456 | 1528899920 |
| <hr/> | | | | | |
| (3) From 492 | (7) 904 | (11) 3238 | (15) 90802 | (19) 9809263784 | (23) 3199119768 |
| Take 246 | 452 | 1619 | 45401 | 4904631892 | 1599559884 |
| <hr/> | | | | | |
| (4) From 506 | (8) 1232 | (12) 9832 | (16) 6280954 | (20) 1234567890 | (24) 797979079 |
| Take 253 | 816 | 4716 | 3140477 | 135790193 | 308987682 |
| <hr/> | | | | | |
- (25) 1017—1st line.
 678—2nd "
 339—3rd " by subtracting the 2nd from the 1st.
 339—4th " " " 3rd " 2nd.

In the same way work the following:—

- | | | | | | |
|--------------|--------------|--------------|--------------|--------------|--------------|
| (26) 2034 | (28) 8136 | (30) 32544 | (32) 130176 | (34) 520704 | (36) 2082816 |
| 1356 | 5424 | 21696 | 86784 | 347136 | 1388544 |
| <hr/> | | | | | |
| (27) 4068 | (29) 16272 | (31) 65088 | (33) 260352 | (35) 1041408 | (37) 4165632 |
| 2712 | 10848 | 43392 | 173568 | 694272 | 2777088 |
| <hr/> | | | | | |
| (38) 7370367 | (40) 7827252 | (42) 9749265 | (44) 9640737 | (46) 9565782 | |
| 4913578 | 5218168 | 6499510 | 6427158 | 6337188 | |
| <hr/> | | | | | |
| (39) 7404072 | (41) 8720304 | (43) 9536868 | (45) 8500461 | (47) 9839607 | |
| 4936048 | 5813536 | 6357912 | 5666974 | 6559738 | |
| <hr/> | | | | | |

XVII.

<i>Example 1st</i> , 31195—18717	<i>Ex. 2d</i> , 6312—3945	<i>Ex. 3d</i> , 13083—8085
31195	6312	13083
18717	3945	8085
12478 = difference of 1st & 2d.	2367 = dif. of 1st & 2d.	4998 d. of 1st & 2d.
6239 " " 2d & 3d.	1578 " " 2d & 3d.	3087 " " 2d & 3d.
6239 " " 3d & 4th.	789 " " 3d & 4th.	1911 " " 3d & 4th.
	789 " " 4th & 5th.	1176 " " 4th & 5th.
		735 " " 5th & 6th.
		441 " " 6th & 7th.
		294 " " 7th & 8th.
		147 " " 8th & 9th.
		147 " " 9th & 10th.

Work as above all the Exercises in this and the remaining Sections.

- | | | |
|-------------------|---------------------|----------------------------|
| (1) 39005—23403 | (5) 678985—407391 | (9) 43466485—26079891 |
| (2) 163270—97962 | (6) 3916340—2349804 | (10) 49382660—29629596 |
| (3) 434885—260931 | (7) 6781190—4088714 | (11) 454545495—272727297 |
| (4) 491865—295119 | (8) 8151515—4890909 | (12) 3394839480—2036903688 |

XVIII.

- | | | |
|---------------|--------------------------|----------------------------|
| (1) 984—615 | (6) 7864—4915 | (11) 1876543128—1172839455 |
| (2) 2760—1725 | (7) 67192—41995 | (12) 45431296—28394560 |
| (3) 3648—2280 | (8) 226864—141790 | (13) 2765431296—1728394560 |
| (4) 4636—2835 | (9) 477096—298185 | (14) 3654312984—2283945615 |
| (5) 6312—3945 | (10) 987654312—617283945 | (15) 4543129872—2839456170 |

XIX.

- | | | | |
|----------------|-----------------|-----------------|-------------------------|
| (1) 4758—2928 | (4) 21424—13184 | (7) 64532—39712 | (10) 100334—61744 |
| (2) 10257—6312 | (5) 29133—17928 | (8) 80002—49232 | (11) 127738—78608 |
| (3) 12532—7712 | (6) 56966—35056 | (9) 92281—56776 | (12) 117741247—72456152 |

XX.

- | | | |
|------------------|---------------------|-----------------------|
| (1) 76398—47294 | (5) 163506—101218 | (9) 304164—188292 |
| (2) 84966—52598 | (6) 177786—110058 | (10) 2007516—1242748 |
| (3) 87822—54366 | (7) 281316—174148 | (11) 16027578—9921834 |
| (4) 113526—70278 | (8) 4285995—2653235 | (12) 12857985—7959705 |

XXI.

- | | | | | |
|-------------|-------------|--------------|----------------|------------------|
| (1) 578—357 | (4) 782—483 | (7) 918—567 | (10) 1428—882 | (13) 1666—1029 |
| (2) 646—399 | (5) 816—504 | (8) 986—609 | (11) 1598—987 | (14) 1768—1092 |
| (3) 714—441 | (6) 850—525 | (9) 1122—693 | (12) 1632—1008 | (15) 33966—20979 |

XXII.

- | | | | |
|---------------|---------------|----------------|----------------|
| (1) 1870—1155 | (5) 2618—1617 | (9) 3366—2079 | (13) 4182—2583 |
| (2) 1904—1176 | (6) 2890—1785 | (10) 3434—2121 | (14) 4318—2667 |
| (3) 1938—1197 | (7) 3196—1974 | (11) 3638—2247 | (15) 4386—2709 |
| (4) 2006—1239 | (8) 2958—1827 | (12) 4046—2499 | (16) 4522—2793 |

(17) 4624—2856	(32) 6052—3738	(47) 9214—5691	(62) 16898—10437
(18) 4726 „ 2919	(33) 5746 „ 3549	(48) 9826 „ 6069	(63) 16966 „ 10479
(19) 4862 „ 3003	(34) 6222 „ 3843	(49) 10166 „ 6279	(64) 17034 „ 10521
(20) 4964 „ 3066	(35) 5984 „ 3696	(50) 10234 „ 6321	(65) 17374 „ 10731
(21) 5032 „ 3108	(36) 6256 „ 3864	(51) 10302 „ 6363	(66) 17646 „ 10899
(22) 5066 „ 3129	(37) 6358 „ 3927	(52) 10506 „ 6489	(67) 17782 „ 10983
(23) 5202 „ 3213	(38) 6766 „ 4179	(53) 10778 „ 6657	(68) 17918 „ 11067
(24) 5270 „ 3255	(39) 7990 „ 4935	(54) 12784 „ 7896	(69) 18122 „ 11193
(25) 5338 „ 3297	(40) 7718 „ 4767	(55) 12206 „ 7539	(70) 18428 „ 11382
(26) 5406 „ 3339	(41) 7786 „ 4809	(56) 13396 „ 8274	(71) 18496 „ 11424
(27) 5542 „ 3423	(42) 8364 „ 5166	(57) 13566 „ 8379	(72) 19278 „ 11907
(28) 5678 „ 3507	(43) 8432 „ 5208	(58) 14484 „ 8946	(73) 19584 „ 12096
(29) 6154 „ 3801	(44) 8466 „ 5229	(59) 15606 „ 9639	(74) 22950 „ 14175
(30) 5848 „ 3612	(45) 8738 „ 5397	(60) 16218 „ 10017	(75) 26010 „ 16065
(31) 6290 „ 3885	(46) 9146 „ 5649	(61) 16592 „ 10248	(76) 27846 „ 17199

SIMPLE MULTIPLICATION.

ORAL EXERCISES—To be practised daily in the class.

- (1) 123456789098765432135790246836948291872917183
 1. Take 2 as multiplier and read aloud the products: 2, 4, 6 &c.
 2. Take 3 do. do. do. 3, 6, 9 &c.
 3. Take 4, 5, 6, 7, 8 and 9 in succession.
- (2) 9898967898679879897896789567894567893456789
 to be multiplied successively by 2, 3, 4, 5, 6, 7, 8, 9. The pupil to read out thus, twice 9 18, 8 and carry one; twice 8 16 and 1 17, 7 and carry one, &c.
- (3) 9081726354590638192632981276582718293578296
 to be multiplied successively by all the digits as No. (2).

XXIII.

Example— $7854 \times 2 = 3456 \times 2 + 4398 \times 2$

$$\begin{array}{rcl}
 \text{thus} & & 7854 \times 2 = 15708 \\
 3456 \times 2 & = & 6912 \\
 4398 \times 2 & = & 8796 \\
 \hline
 & & 15708
 \end{array}$$

Shew that

- (1) $47 \times 2 = 19 \times 2 + 28 \times 2$ (6) $369 \times 2 = 246 \times 2 + 123 \times 2$
- (2) $59 \times 2 = 27 \times 2 + 32 \times 2$ (7) $615 \times 2 = 369 \times 2 + 246 \times 2$
- (3) $75 \times 2 = 49 \times 2 + 26 \times 2$ (8) $984 \times 2 = 615 \times 2 + 369 \times 2$
- (4) $89 \times 2 = 37 \times 2 + 52 \times 2$ (9) $1725 \times 2 = 1035 \times 2 + 690 \times 2$
- (5) $124 \times 2 = 56 \times 2 + 68 \times 2$ (10) $3648 \times 2 = 2280 \times 2 + 1368 \times 2$

Note, Instead of 2 as multiplier take successively 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 as multipliers, using the exercises in the section thus,

- (5) $124 \times 9 = 56 \times 9 + 68 \times 9$ &c.

SELF-TESTING ARITHMETIC.—MULTIPLICATION.

XXIV.

Example— $369456 \times 47 = 369456 \times 19 + 369456 \times 28$

<i>thus</i> 369456	369456	369456
47	19	28
<hr/>	<hr/>	<hr/>
2586192	3325104	2955648
1477824	369456	738912
<hr/>	<hr/>	<hr/>
17364432	7019664	10344768
	10344768	
	<hr/>	
	17364432	

Show that

- (1) $780934 \times 14 = 780934 \times 6 + 780934 \times 8$
 (2) $937835 \times 19 = 937835 \times 8 + 937835 \times 11$
 (3) $849863 \times 25 = 849863 \times 12 + 849863 \times 13$
 (4) $980917 \times 37 = 980917 \times 18 + 980917 \times 19$
 (5) $365999 \times 49 = 365999 \times 24 + 365999 \times 25$
 (6) $980717 \times 65 = 980717 \times 39 + 980717 \times 26$
 (7) $932956 \times 104 = 932956 \times 39 + 932956 \times 65$
 (8) $707714 \times 143 = 707714 \times 88 + 707714 \times 55$
 (9) $919199 \times 369 = 919199 \times 246 + 919199 \times 123$
 (10) $970793 \times 678 = 970793 \times 321 + 970793 \times 357$

Note. With the multipliers in Exercise 1st, (14 and 6) multiply all the other multiplicands; and so with all the others.

XXV.

Sum of Factors = 1000

Example— $369834 \times 456 + 369834 \times 544 = 369834 \times 1000$.

- (1) 783967×535 & 465 (6) 678398×324 & 676 (11) 809197×798 & 202
 (2) 649864×797 & 203 (7) 567897×178 & 822 (12) 980071×839 & 161
 (3) 903296×971 & 29 (8) 732659×393 & 607 (13) 987709×194 & 806
 (4) 787864×291 & 709 (9) 309109×357 & 643 (14) 8039009×401 & 599
 (5) 325436×707 & 293 (10) 987614×321 & 679 (15) 8998076×499 & 501

See note to Section XXIV.

XXVI.

Multiply and add together the products of

- (1) 3073294 by 701 and 299 (6) 359607842 by 798 and 207; also by 808 and 192
 (2) 8239657 by 679 and 321 (7) 460718953 by 827 and 173; also by 901 and 99
 (3) 9876543 by 348 and 652 (8) 571829087 by 531 and 469; also by 11 and 989
 (4) 2190878 by 959 and 41 (9) 632242838 by 204 and 796; also by 37 and 963
 (5) 9129679 by 869 and 131 (10) 788091976 by 304 and 696; also by 89 and 911

See note to Section XXIV.

XXVII.

Sum of multipliers = 10,000

Multiply

- (1) 780342689 by 1234 and 8766 (2) by 7891 and 2109 (3) by 4286 and 5714
 (4) 346298797 by 2345 and 7655 (5) by 3579 and 6421 (6) by 6248 and 3752
 (7) 560783429 by 3456 and 6544 (8) by 1357 and 8643 (9) by 8624 and 1376
 (10) 807623498 by 5678 and 4322 (11) by 2468 and 7532 (12) by 4628 and 5372
 (13) 789005967 by 6789 and 3211 (14) by 4282 and 5718 (15) by 7312 and 2688
 (16) 345632349 by 6954 and 3046 (17) by 7913 and 2087 (18) by 3039 and 6961
 (19) 296234989 by 3890 and 6110 (20) by 7809 and 2191 (21) by 5508 and 4492
 (22) 707063984 by 5680 and 4320 (23) by 6009 and 3991 (24) by 9009 and 991
 (25) 640019827 by 8969 and 1031 (26) by 9267 and 733 (27) by 9563 and 437
 (28) 209067639 by 27 and 9973 (29) by 99 and 9901 (30) by 365 and 9635

See note to Section XXIV.

XXVIII.

Example—Multiply 9812 by 34 and 21 and subtract the products as explained in Section XVII, and then add.

9812 × 34 = 333608	then	333608
9812 × 21 = 206052		206052
		127556
		78496
		48060
		29436
		19624
		9812
		<u>9812</u>
		863456

In the same way, multiply, subtract, and add

- (1) 34567 by 34 & 21 (6) by 55 & 34 (11) by 89 & 55 (16) by 610 & 377
 (2) 79632 by 34 & 21 (7) by 55 & 34 (12) by 144 & 89 (17) by 610 & 377
 (3) 80361 by 34 & 21 (8) by 55 & 34 (13) by 233 & 144 (18) by 1597 & 987
 (4) 96329 by 34 & 21 (9) by 55 & 34 (14) by 233 & 144 (19) by 2584 & 1597
 (5) 320967 by 34 & 21 (10) by 55 & 34 (15) by 377 & 233 (20) by 4181 & 2584

XXIX.

In the following exercises divide into two periods of two figures each, use these as multipliers, and test the results as in the following example.

5742 thus divided gives the multipliers 57, 42, then

$$\begin{array}{r} 5742 \times 57 = 327294 \\ \times 42 = 241164 \end{array}$$

Sum of products = 568458

The multiplicand = 5742

Sum of products and multiplicand = 574200 = 100 times the multiplicand.

Or it may be tested by subtraction, thus

100 times the multiplicand = 574200

Sum of products = 568458

Difference of products and multiplicand = 5742 = the multiplicand.

Note—In the exercises in this and the two Sections following, the teacher will observe that every line in the working, and every product, is a multiple of nine, and by adding the digits in any line or product he can ascertain if it is correct.

(1) 3762	(6) 3861	(11) 3960	(16) 3168	(21) 4851	(26) 7524	(31) 3564
(2) 2376	(7) 2871	(12) 5148	(17) 5445	(22) 6138	(27) 5247	(32) 4356
(3) 2475	(8) 2178	(13) 7326	(18) 6831	(23) 3366	(28) 4752	(33) 4653
(4) 1782	(9) 3267	(14) 4158	(19) 2673	(24) 2772	(29) 5742	(34) 5346
(5) 3663	(10) 4356	(15) 7128	(20) 1980	(25) 2574	(30) 7425	(35) 6534

XXX.

Divide into *two* periods of *three* figures each; use these as multipliers, and proceed as in Section XXIX. Thus, 134865 gives for its multipliers, 134, 865.

(1) 134865	(7) 357642	(13) 427572	(19) 763236	(25) 586413
(2) 296703	(8) 403536	(14) 456543	(20) 789210	(26) 475524
(3) 237762	(9) 375624	(15) 502497	(21) 892107	(27) 486513
(4) 380619	(10) 705294	(16) 617382	(22) 807192	(28) 390609
(5) 523476	(11) 309690	(17) 694305	(23) 735264	(29) 420579
(6) 491508	(12) 329670	(18) 264735	(24) 702297	(30) 614385

XXXI.

Divide into *three* periods of *two* figures each; use these as multipliers and proceed as in Section XXIX. Thus 172458 gives for its multipliers, 17, 24, 58.

(1) 172458	(9) 351252	(17) 372834	(25) 234531	(33) 192357
(2) 163647	(10) 503118	(18) 422532	(26) 342738	(34) 235719
(3) 432135	(11) 281853	(19) 341946	(27) 453123	(35) 271359
(4) 571329	(12) 591426	(20) 492624	(28) 273438	(36) 571923
(5) 344619	(13) 601524	(21) 571626	(29) 382734	(37) 591723
(6) 232947	(14) 381942	(22) 322938	(30) 391743	(38) 341649
(7) 591624	(15) 403524	(23) 481239	(31) 463617	(39) 472824
(8) 671418	(16) 561726	(24) 701415	(32) 582912	(40) 571428

SIMPLE DIVISION.

EXERCISES—To be solved viva voce by the class.

2 4 6 8 0 3 6 9 4 8 5 7 3 7 6 5 2 3 9 6 5 8 3 2 1 5 0 6 7 8 9 1 4 6 8 4 6

Divide successively by 2, 3, 4, &c.

6 3 8 7 6 3 2 5 9 0 4 9 9 0 1 3 7 8 9 4 6 2 8 1 2 6 9 9 0 7 0 7 8 1 1 1 1 7 7 6 1 9 1

Divide successively by 2, 3, 4, 5, &c.

XXXII.

Example $364 \div 2$

$$\begin{array}{r} 2 \overline{)364} \\ 182 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Proof } 182 \\ 2 \\ \hline 364 \end{array}$$

$$\begin{array}{r} 2 \overline{)364} (182 \\ 2 \\ \hline 16 \\ 16 \\ \hline 4 \\ 4 \end{array}$$

In the same way solve, and prove, the following Exercises.

- (1) $26324 \div 2 = 13162$ (6) $369 \div 3 = 123$ (11) $3852 \div 4 = 963$
 (2) $34833 \div 3 = 11611$ (7) $1035 \div 5 = 207$ (12) $1935 \div 9 = 215$
 (3) $52384 \div 4 = 13096$ (8) $1368 \div 4 = 342$ (13) $5787 \div 9 = 643$
 (4) $80560 \div 5 = 16112$ (9) $1701 \div 7 = 243$ (14) $8325 \div 9 = 925$
 (5) $73632 \div 6 = 12272$ (10) $7866 \div 9 = 874$ (15) $9909 \div 9 = 1101$

XXXIII.

- (1) $323464 \div 6 = 53910 \frac{4}{3}$ (6) $123456 \div 6 = 20576$
 (2) $567891 \div 6 = 94648 \frac{3}{2}$ (7) $234567 \div 6 = 39094 \frac{3}{2}$
 (3) $732132 \div 6 = 122022$ (8) $345678 \div 6 = 57613$
 (4) $596329 \div 8 = 74541 \frac{1}{8}$ (9) $456789 \div 8 = 57098 \frac{5}{8}$
 (5) $632364 \div 8 = 79045 \frac{4}{8}$ (10) $567890 \div 8 = 70986 \frac{2}{8}$
 (6) $702371 \div 7 = 100338 \frac{5}{7}$ (11) $64474 \div 8 = 8059 \frac{2}{8}$
 (7) $813432 \div 7 = 116204 \frac{4}{7}$ (12) $345280 \div 7 = 49325 \frac{5}{7}$
 (8) $511632 \div 7 = 73090 \frac{4}{7}$ (13) $346373 \div 7 = 49481 \frac{6}{7}$
 (9) $139629 \div 11 = 12693 \frac{6}{11}$ (14) $210669 \div 7 = 30095 \frac{4}{7}$
 (10) $908063 \div 11 = 82551 \frac{2}{11}$ (15) $36538 \div 11 = 3321 \frac{7}{11}$

See note to Section XXIV.

XXXIV.

Example—Shew that $55296 \div 16 = 3456$ and $55296 \div 8 = 6912$

16)55296(3456

$$\begin{array}{r} 48 \\ \hline 72 \\ 64 \\ \hline 89 \\ 80 \\ \hline 98 \\ 96 \end{array}$$

8)55296

$$\begin{array}{r} 2)6912 \\ \hline 3456 \end{array}$$

or

4)55296

$$\begin{array}{r} 4)13824 \\ \hline 3456 \end{array}$$

Shew that

- (1) $732648 \div 24 = 30527$ (7) $801364 \div 28 = 28620 \frac{1}{7}$ and 4
 (2) $890656 \div 24 = 37109 \frac{1}{3}$ (8) $239673 \div 32 = 7489 \frac{9}{8}$ and 8
 (3) $632164 \div 24 = 26340 \frac{1}{6}$ (9) $813277 \div 36 = 22590 \frac{1}{4}$ and 9
 (4) $739634 \div 24 = 30818 \frac{1}{6}$ (10) $653260 \div 40 = 16331 \frac{1}{2}$ and 8
 (5) $616896 \div 21 = 29376$ (11) $986464 \div 42 = 23487 \frac{2}{3}$ and 7
 (6) $254016 \div 63 = 4032$ (12) $200376 \div 72 = 2783$ and 9

XXXV.

In the following Exercises the Remainders (if any) are divisible by nine. Each Dividend is divisible by all the Divisors with Remainder as above. This Section, therefore, contains 6561 Exercises.

Dividenda.	Divisors.	Dividenda.	Divisors.	Dividenda.	Divisors.
(1) 234567	18	(10) 12345678	108	(19) 23659245	126
(2) 345672	27	(11) 23456781	207	(20) 37018764	135
(3) 427311	36	(12) 34567812	306	(21) 48321189	144
(4) 543672	45	(13) 40107645	405	(22) 30198762	153
(5) 672345	54	(14) 57763323	504	(23) 56329659	162
(6) 751113	63	(15) 69960286	603	(24) 63068787	171
(7) 804024	72	(16) 79865379	702	(25) 26875431	207
(8) 887625	81	(17) 81133686	801	(26) 38964843	216
(9) 999999	99	(18) 90909963	117	(27) 39746566	225
(28) 753194745	234	(37) 1357914321	342	(46) 111111111	441
(29) 864293436	243	(38) 2429876511	351	(47) 44499978	459
(30) 973118727	252	(39) 3019863843	369	(48) 469193643	468
(31) 319809924	261	(40) 3654876996	378	(49) 478326323	477
(32) 537065730	279	(41) 3745219212	387	(50) 5111111700	486
(33) 621090909	288	(42) 39509000487	396	(51) 5050638000	495
(34) 366476500	297	(43) 41236476300	414	(52) 7290000000	513
(35) 135798300	315	(44) 42296237802	423	(53) 630000000	522
(36) 726390000	324	(45) 43200109998	432	(54) 5876910	531
(55) 53146827	549	(64) 356912478	747	(73) 709005474	882
(56) 61327548	558	(65) 981762345	756	(74) 470049570	918
(57) 128761353	567	(66) 765432189	765	(75) 357114636	936
(58) 123456789	576	(67) 781965423	774	(76) 987654321	954
(59) 987654321	585	(68) 783993456	783	(77) 976548321	972
(60) 963187452	594	(69) 792345681	792	(78) 981234567	981
(61) 712345689	711	(70) 829713456	828	(79) 912837654	999
(62) 723918645	729	(71) 846123579	846	(80) 900664200	9099
(63) 791352468	738	(72) 864123597	864	(81) 111777111	9009

XXXVI.

Take any two numbers—add them—divide by this sum each of the numbers separately, after adding as many ciphers as may be thought necessary. The sum of the quotients will be equal to the number represented by one followed by as many ciphers as were added.

Thus—take the numbers 67 and 49, and divide by their sum, after adding, say, five ciphers.

$$\begin{array}{r} 67 \\ 49 \\ \hline 116 \end{array}$$

(a) $116)8700000(57758\frac{77}{116}$

$$\begin{array}{r}
 580 \\
 900 \\
 812 \\
 \hline
 880 \\
 812 \\
 \hline
 680 \\
 580 \\
 \hline
 1000 \\
 928 \\
 \hline
 72 \\
 116
 \end{array}$$

(b) $116)4900000(42241\frac{44}{116}$

$$\begin{array}{r}
 464 \\
 280 \\
 232 \\
 \hline
 280 \\
 232 \\
 \hline
 480 \\
 464 \\
 \hline
 160 \\
 116 \\
 \hline
 44 \\
 116
 \end{array}$$

$$\begin{array}{r}
 (a) 57758\frac{77}{116} \\
 (b) 42241\frac{44}{116}
 \end{array}$$

Sum of quotients—100000 = 1 followed by as many ciphers as were added.

XXXVII.

Another method—To one annex as many ciphers as you please. From this subtract any number. To the two numbers thus formed prefix two figures whose sum is less than the proposed divisor by one, then divide by the proposed divisor. This, like the preceding, is applicable to Short as well as Long Division.

Examples—To 1 annex 5 ciphers, thus—100000

From this subtract any number (say) 53719 (a)

Leaving

46281 (b)

Take any divisor, say 9. To (a) and (b) prefix two figures whose sum = 9 less 1, i. e. to 8. Say 3 and 5, then—

$$\begin{array}{r}
 9)3.53719 \\
 \hline
 39302.1
 \end{array}$$

$$\begin{array}{r}
 9)5.46281 \\
 \hline
 60697.8
 \end{array}$$

$$\text{Answers, } \begin{cases} (a) 39302.1 \\ (b) 60697.8 \end{cases}$$

Sum of do., 100000

For Long Division take, say 39. Prefix figures as before.

$$39)18.53719(47531\frac{19}{39}$$

$$\begin{array}{r}
 156 \\
 293 \\
 273 \\
 \hline
 207 \\
 195 \\
 \hline
 121 \\
 117 \\
 \hline
 49 \\
 39 \\
 \hline
 10
 \end{array}$$

$$39)20.46281(52468\frac{31}{39}$$

$$\begin{array}{r}
 195 \\
 96 \\
 78 \\
 \hline
 183 \\
 156 \\
 \hline
 268 \\
 234 \\
 \hline
 341 \\
 312 \\
 \hline
 29
 \end{array}$$

$$\text{Answers, } \begin{cases} (a) 47531\frac{19}{39} \\ (b) 52468\frac{31}{39} \end{cases}$$

Sum of do., 100000

The Teacher will find numbers prepared for this method in the multipliers of Section XXVII.

MULTIPLICATION & DIVISION BY FRACTIONAL NUMBERS.

XXXVIII.

Example—Multiply 23567 and 76433 by $3\frac{1}{2}$.

23567 <u>3$\frac{1}{2}$</u>	76433 <u>3$\frac{1}{2}$</u>	Products. 82484 $\frac{1}{2}$ (a) 267515 $\frac{1}{2}$ (b)
11783 $\frac{1}{2}$ = $\frac{1}{2}$ × 23567	38216 $\frac{1}{2}$ = $\frac{1}{2}$ × 76433	350000 = sum = 100000 × 3 $\frac{1}{2}$
70701 " 3 " "	229299 " 3 " "	
(a) 82484 $\frac{1}{2}$ " 3 $\frac{1}{2}$ " "	(b) 267515 $\frac{1}{2}$ " 3 $\frac{1}{2}$ " "	

In the same way multiply and add the products of

- | | |
|---------------------------------------|--------------------------------------|
| (1) 34678 and 65322 by $1\frac{1}{2}$ | (5) 1234 and 8766 by $9\frac{1}{2}$ |
| (2) 55789 and 44211 by $3\frac{1}{2}$ | (6) 2345 and 7655 by $12\frac{1}{2}$ |
| (3) 67891 and 32109 by $5\frac{1}{2}$ | (7) 3456 and 6544 by $30\frac{1}{2}$ |
| (4) 78337 and 21663 by $7\frac{1}{2}$ | (8) 5678 and 4322 by $49\frac{1}{2}$ |

XXXIX.

Multiply 38426327 by $2\frac{1}{2}$, and by $7\frac{1}{2}$, and add the products.

38426327 <u>2$\frac{1}{2}$</u>	38426327 <u>7$\frac{1}{2}$</u>	Products. (a) 85391837 $\frac{1}{2}$ (b) 298871432 $\frac{1}{2}$
76852654	268984289	
8539183 $\frac{1}{2}$	29887143 $\frac{1}{2}$	384263270 = 38426327 × 10
(a) 85391837 $\frac{1}{2}$	(b) 298871432 $\frac{1}{2}$	
(1) 49537439 by $2\frac{1}{2}$ and $7\frac{1}{2}$	(6) 6324697 by $21\frac{1}{2}$ and $73\frac{1}{2}$	
(2) 90182653 by $3\frac{1}{2}$ and $6\frac{1}{2}$	(7) 7693254 by $42\frac{1}{2}$ and $57\frac{1}{2}$	
(3) 69326547 by $4\frac{1}{2}$ and $5\frac{1}{2}$	(8) 8096539 by $44\frac{1}{2}$ and $55\frac{1}{2}$	
(4) 70677873 by $6\frac{1}{2}$ and $3\frac{1}{2}$	(9) 9365871 by $67\frac{1}{2}$ and $32\frac{1}{2}$	
(5) 9763234 by $4\frac{1}{2}$ and $15\frac{1}{2}$	(10) 1010101 by $69\frac{1}{2}$ and $39\frac{1}{2}$	

XI.

Multiply 697 and 832 respectively by $2\frac{1}{2}$, and divide the sum of the products by $2\frac{1}{2}$

697 <u>2$\frac{1}{2}$</u>	and	832 <u>2$\frac{1}{2}$</u>	Products. (a) 1858 $\frac{1}{2}$ (b) 2218 $\frac{1}{2}$	2 $\frac{1}{2}$ 4077 $\frac{1}{2}$ 3 3 8)12232
1394		1664		
464 $\frac{1}{2}$		554 $\frac{1}{2}$	4077 $\frac{1}{2}$	1529 = 697 + 832
(a) 1858 $\frac{1}{2}$		(b) 2218 $\frac{1}{2}$		

Multiply

- | | | |
|--|--|-----------------|
| (1) 63395 by $4\frac{1}{2}$ and 728 by $4\frac{1}{2}$ | and divide the sum of the products by $4\frac{1}{2}$ | |
| (2) 17629 by $3\frac{1}{2}$ and 829 by $3\frac{1}{2}$ | " | 3 $\frac{1}{2}$ |
| (3) 28731 by $5\frac{1}{2}$ and 527 by $5\frac{1}{2}$ | " | 5 $\frac{1}{2}$ |
| (4) 39498 by $6\frac{1}{2}$ and 219 by $6\frac{1}{2}$ | " | 6 $\frac{1}{2}$ |
| (5) 43978 by $9\frac{1}{2}$ and 853 by $9\frac{1}{2}$ | " | 9 $\frac{1}{2}$ |
| (6) 54567 by $8\frac{1}{2}$ and 7429 by $8\frac{1}{2}$ | " | 8 $\frac{1}{2}$ |
| (7) 69017 by $7\frac{1}{2}$ and 8107 by $7\frac{1}{2}$ | " | 7 $\frac{1}{2}$ |

REDUCTION.

XLI.

Examples—Reduce 3s. 9d. to pence and farthings. Reduce £3 5s. 0½d. to farth.

$$\begin{array}{r} 3s. 9d. \\ 12 \\ \hline 45 \text{ pence.} \\ 4 \\ \hline 180 \text{ farthings.} \end{array}$$

$$\begin{array}{r} £3, 5s. 0\frac{1}{2}d \\ 20 \\ \hline 65 \text{ shillings} \\ 12 \\ \hline 780 \text{ pence.} \\ 4 \\ \hline 3123 \text{ farthings.} \end{array}$$

Note—The Teacher by adding the digits in the answers of these examples will have the Key to the answers in this Section.

Reduce to farthings.

£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
(1) 0 1 8½	0 8 5½	0 3 4½	(6) 103 12 9½	354 10 10½	530 17 2½
(2) 0 13 6	0 12 9	0 15 2½	(7) 3974 0 8½	5221 4 2½	0 5 0½
(3) 1 1 11½	2 0 6	2 17 4½	(8) 1009 15 5½	5575 15 0½	531 2 3
(4) 2 7 7½	3 11 5½	5 13 3	(9) 4983 16 1½	10796 19 3	531 7 3½
(5) 28 1 11½	64 15 5½	129 3 0	(10) 5993 11 6½	16372 14 3½	1062 9 6½

XLII.

Examples—Reduce to pence 540 farthings. Reduce to shillings 29808 farthings.

$$\begin{array}{r} (1) \ 4 \overline{)540} \\ 135 \text{ pence.} \end{array}$$

$$\begin{array}{r} (2) \ 4 \overline{)29808} \\ 12 \overline{)7452} \text{ pence.} \\ 621 \text{ shillings.} \end{array}$$

Reduce to pounds 15270 pence. Reduce to pounds 311267 farthings.

$$\begin{array}{r} (3) \ 12 \overline{)15270} \\ 2,0 \overline{)127,2s. 6d.} \\ £63 \ 12s. 6d. \end{array}$$

$$\begin{array}{r} (4) \ 4 \overline{)311267} \\ 12 \overline{)77816\frac{1}{2}d.} \\ 2,0 \overline{)648,4s. 8d.} \\ £324 \ 4s. 8\frac{1}{2}d. \end{array}$$

Note—The test for exercises like the examples (1) and (2) is the same as in Section XLI. For exercises like the examples (3) and (4), the same test for the pounds, then double the two right hand figures, calling the units pence, and the other figures shillings—Thus, £36 7s. 2d. Here the number of pounds = 36. Test the pounds by the sum of the digits. Then, $36 \times 2 = 72$, take 2 for pence, and 7 for shillings.

If, as in example (4), the answer contains three figures, and the left hand figure under four, then for pounds, shillings, and pence, the same test as before, and for farthings the same number as the left hand figure. Thus, in the example, the number of pounds is 324. Test the pounds by the sum of the digits. Then, $24 \times 2 = 48$, take 8 for pence, and 4 for shillings. The left hand figure is 3—take 3 for farthings.

Reduce to Pounds

- | | | |
|----------------------|----------------------|------------------------|
| (1) 17448 farthings. | (6) 34904 farthings. | (11) 10908 pence. |
| (2) 43632 " | (7) 78536 " | (12) 103753 farthings. |
| (3) 138657 " | (8) 156113 " | (13) 164841 " |
| (4) 182289 " | (9) 198786 " | (14) 216242 " |
| (5) 21816 halfpence. | (10) 302547 " | (15) 21600 halfpence. |

XLIII.

- | | |
|---|-------------------------------------|
| (1) Reduce 197424 farthings to shillings. | (8) 288 pence to groats. |
| (2) " 540 sixpences to crowns. | (9) 2268 groats to guineas. |
| (3) " 810 pence to halfcrowns. | (10) 171504 halfpence to shillings. |
| (4) " 2160 halfpence to crowns. | (11) 756 shillings to guineas. |
| (5) " 720 farthings to groats. | (12) 6480 farthings to crowns. |
| (6) " 2700 pence to crowns. | (13) 504 half crowns to pounds. |
| (7) " 54432 farthings to guineas | (14) 4536 threepences to guineas. |

XLIV.

- | | |
|---|-----------------------------|
| (1) Reduce £4, 17s. 10½d. to halfpence. | (4) 4320 groats to pounds. |
| (2) " 2835 groats to guineas. | (5) £15, 15s. to sixpences. |
| (3) " 3402 sixpences to guineas. | (6) 15s. 4½d. to halfpence. |

XLV.

TROY WEIGHT.

- (1) Reduce to grs. 31 lbs. 10 oz. 8 dwts. 12 grs. (2) Reduce 28197 dwts. to lbs.

<i>lbs.</i>	<i>oz.</i>	<i>dwts.</i>	<i>grs.</i>
31	8	10	12
12			
382			
20			
7648			
24			
30604			
15296			
183564			

<i>dwts.</i>
2,0)2819,7
12)1409 17
117 lbs. 5 oz. 17 dwts.

TEST FOR EXERCISES IN WEIGHTS AND MEASURES.

For exercises like (1), the same test as in Section XII. In exercises like (2), the number of the highest denomination to be tested in the same way, and the same number of the lowest denomination taken. Thus, in example (2) the number of highest denomination is 117 (test by the sum of the digits). Then, the same number of the lowest denomination, 117 dwts. i. e. 5 oz. 17 dwts.

- | | |
|---------------------------------|------------------------------------|
| (1) Reduce 51840 grains to lbs. | (5) 4320 grs. to oz. |
| (2) " 155520 grains to lbs. | (6) 9 oz. 12 dwts. 18 grs. to grs. |
| (3) " 103680 grains to lbs. | (7) 1 lb. 1 oz. 19 dwts. to grs. |
| (4) 17280 dwts. to lbs. | (8) 1 lb. 3 oz. 9 dwts. to grs. |

- | | |
|---------------------------------------|--|
| (9) 16 lbs. 9 oz. 3 dwts. to dwts. | (13) 10 lbs. 9 oz. 9 dwt. 9 gra. to gra. |
| (10) 20 lbs. 10 oz. 13 dwts. to dwts. | (14) 207396 gra. to lbs. |
| (11) 4338 dwts. to lbs. | (15) 1 lb. 5 oz. 2 dwts. to gra. |
| (12) 155547 gra. to lbs. | (16) 4 lbs. 10 oz. 6 gra. to gra. |

XLVI.**APOTHECARIES WEIGHT.**

- | | |
|----------------------------------|-------------------------------------|
| (1) Reduce 4620 grains to drams. | (9) 27 lbs. 1 scr. 7 gra. to gra. |
| (2) " 8640 grains to oz. | (10) 36 lbs. 1 scr. 16 gra. to gra. |
| (3) " 207360 grains to lbs. | (11) 1728 dra. to lbs. |
| (4) " 259200 grains to lbs. | (12) 2592 scr. to lbs. |
| (5) " 311040 grains to lbs. | (13) 45 lbs. 2 scr. 5 gra. to gra. |
| (6) " 16 oz. 18 gra. to gra. | (14) 4320 gra. to oz. |
| (7) " 9 lbs. 1 oz. 1 dr. to dra. | (15) 63 lbs. 1 dr. 3 gra. to gra. |
| (8) " 18 lbs. 6 dra. to scr. | (16) 84 lbs 7 oz. 7 dra. to grains. |

XLVII.**AVOIRDUPOIS WEIGHT.**

- | | | |
|-------------------------------------|---|--------|
| (1) Reduce 6939 dra. to lbs. | (9) 54 cwt. 3 oz. 6 dra. to dra. | [dra.] |
| (2) " 129042 dra. to qrs. | (10) 14 tons 7 cwt. 2 qrs. 13 lbs. 2 oz. 14 dra. to | |
| (3) " 1032228 dra. to cwts. | (11) 16137 oz. to cwts. | |
| (4) " 40338 lbs. to tons. | (12) 20169 lbs. to tons. | |
| (5) " 645138 oz. to tons. | (13) 8 cwt. 2 qrs. 19 lbs. 4 oz. 12 dra. to dra. | |
| (6) " 36 lbs. 2 oz. 4 dra. to dra. | (14) 1 ton 2 cwt. 3 qrs. 7 lbs. 9 oz. 14 dra. to dra. | |
| (7) " 45 qrs. 2 oz. 13 dra. to dra. | (15) 22 tons 13 cwt. 1 qr. 4 lbs. 9 oz. to oz. | |
| (8) " 27 cwt. 1 lb. 11 oz. to oz. | (16) 25 tons 2 cwt. 1 qr. 13 oz. to oz. | |

XLVIII.**MEASURE OF CAPACITY.**

- | | |
|--|--|
| (1) Reduce 2304 gills to gals. | (9) 10 bu. 2 pks. 1 qt. 1 pt. to gills. |
| (2) " 2880 gills to pks. | (10) 1 qr. 7 bu. 2 pks. 3 qts. 1 pt. to pts. |
| (3) " 18432 gills to bu. | (11) 585 pts. to bu. |
| (4) " 73728 pts. to qrs. | (12) 4626 qts. to qrs. |
| (5) " 589824 gills to qrs. | (13) 6939 qts. to qrs. |
| (6) " 19 gals. 1 pt. to gills. | (14) 2 bu. 1 pk. 3 qts. 3 gills to gills. |
| (7) " 11 pks. 1 gal. 1 qt. 3 gills to gills. | (15) 242 qrs. 6 bu. 1 qt. to qts. |
| (8) " 3 bu. 1 gal. 1 gill to gills. | (16) 253 qrs. 6 bu. 2 pks. 1 gal. to qts. |

XLIX.**LINEAL MEASURE.**

- | | |
|------------------------------|---------------------------------|
| (1) Reduce 71280 in. to fur. | (4) " 63360 yds. to miles. |
| (2) " 3564 in. to po. | (5) " 570240 in. to miles. |
| (3) " 14400 po. to miles. | (6) " 18 po. 1 ft. 6 in. to in. |

- | | |
|---|---|
| (7) " 36 po. 3 ft. to in. | (12) 190080 ft. to miles. |
| (8) " 9 fur. 3 yds. to ft. | (13) 54 m. 9 po. $4\frac{1}{2}$ yds. to yds. |
| (9) 45 m. 8 po. 1 yd. to yds. | (14) 63 m. 11 po. $2\frac{1}{2}$ yds. to yds. |
| (10) 27 m. 1 po. $3\frac{1}{2}$ yds. to ft. | (15) 72 m. 13 po. $\frac{1}{2}$ yd. to yds. |
| (11) 47520 yds. to miles. | (16) 74 miles 5 fur. 1 po. $\frac{1}{2}$ yd. to yards |

L.

SQUARE MEASURE.

- | | |
|----------------------------------|---|
| (1) Reduce 1058535 in. to po. | (9) 126 ac. 4 po. 5 yds. to yds. |
| (2) " 1411380 in. to po. | (10) 162 ac. 5 po. $10\frac{1}{2}$ yds. to yds. |
| (3) " 304983 yds. to acres. | (11) 21735 po. to acres. |
| (4) " 261414 yds. to acres. | (12) 697104 yds. to acres. |
| (5) " 8694 poles to acres. | (13) 275 ac. 3 rds. 7 po. to po. |
| (6) " 9 po. 9 in. to in. | (14) 72 ac. 2 po. $11\frac{1}{2}$ yds. to yds. |
| (7) " 99 ac. 2 ro. 19 po. to po. | (15) 90 acres 2 poles $29\frac{1}{2}$ yards to yards. |
| (8) " 90 ac. 18 yds. to yds. | (16) 94 acres 2 ro. 1 po. $5\frac{1}{2}$ yds. to yds. |

LI.

CLOTH MEASURE.

- | | |
|---------------------------------|-------------------------------------|
| (1) Reduce 648 in. to yds. | (9) 36 E. ells to inches. |
| (2) " 972 in. to Fl. ells. | (10) 45 Fr. ells. 5 qrs. to inches. |
| (3) " 1215 in. to E. ells. | (11) 2268 in. to qrs. |
| (4) " 2430 in. to Fr. ells. | (12) 3888 in. to Fr. ells. |
| (5) " 3645 in. to E. ells. | (13) 275 Fr. ells to inches. |
| (6) " 377 yds. to in. | (14) 93 Fl. ells 1 qr. to inches. |
| (7) " 27 yds. 3 qrs. to inches. | (15) 137 Fr. ells 3 qrs. to inches. |
| (8) " 9 Fl. ells to inches. | (16) 142 E. ells 4 qrs. to inches. |

LII.

TIME MEASURE.

- | | |
|--|---|
| (1) Reduce 103680 min. to days. | (9) 36 yrs. 9 hrs. 36 min. to min. |
| (2) " 4665600 sec. to days. | (10) 9 yrs. 2 hrs. 45 min. 9 sec. to sec. |
| (3) " 9460800 min. to years. | (11) 233260 min. to days. |
| (4) " 283824000 sec. to years. | (12) 9331200 sec. to days. |
| (5) " 116721 min. to days. | (13) 365 da. 5 hr. 48 min. 45 sec. to sec. |
| (6) " 18 dys. 27 min. 18 sec. to sec. | (14) 5 yrs. 2 hrs. 54 min. 36 sec. to sec. |
| (7) " 27 dys. 36 min. 27 sec. to sec. | (15) 7 yrs. 18 hrs. 45 min. 27 sec. to sec. |
| (8) " 730 d. 11 h. 37 m. 30 sec. to sec. | (16) 8 yrs. 5 days 45 min. to seconds. |

LIII.

MISCELLANEOUS.

- | | |
|---|--|
| (1) Reduce 7 qrs. 4 bu. 2 pks. 3 qts. 1 pt. to pts. | (6) 17334 poles to miles. |
| (2) " 36414 dwts. (Troy) to pounds. | (7) 19 ac. 39 po. $19\frac{1}{2}$ yds. to yds. |
| (3) " $36\frac{1}{2}$ yards to inches. | (8) 13878 drs. (Avoir.) to lbs. |
| (4) " 891 pecks to quarters. | (9) 5 m. 4 fur. 35 po. $\frac{1}{2}$ yd. to yds. |
| (5) " 6 tons 11 cwt. 2 qrs. 22 lbs. 7 oz. to oz. | (10) 18837 poles to acres. |

LIV.

[illegible]

\pounds	$s.$	$d.$	\pounds	$s.$	$d.$	\pounds	$s.$	$d.$	\pounds	$s.$	$d.$
(10) 2	3	6½	(11) 7	17	9¾	(12) 25	11	7½	(13) 367	9	8½
2	3	6½	7	17	9¾	25	11	7½	367	9	8½
4	7	1	15	15	7½	51	3	2½	734	19	4½
6	10	7½	23	13	5¼	76	14	9¾	1102	9	0¾
10	17	8½	39	9	0¾	127	18	0¼	1837	8	5¼
17	8	3	63	2	6	204	12	10	2939	18	6

6r	8r	6r	6r	6r	6r	6r
d.	d.	d.	s. d.	s. d.	s. d.	s. d.
(1) $\frac{1}{2}$	(5) $2\frac{1}{2}$	(9) $11\frac{1}{2}$	(13) $10\frac{1}{2}$	(17) 3 10	(21) 14 $6\frac{1}{2}$	(25) 11 $11\frac{1}{2}$
(2) $\frac{1}{2}$	(6) 7	(10) $3\frac{3}{4}$	(14) $11\frac{1}{2}$	(18) 5 7	(22) 17 9	(26) 18 $4\frac{1}{2}$
(3) $\frac{1}{2}$	(7) $9\frac{1}{2}$	(11) $7\frac{3}{4}$	(15) 2 $2\frac{3}{4}$	(19) 7 $1\frac{1}{2}$	(23) 13 $3\frac{3}{4}$	(27) 19 $10\frac{1}{2}$
(4) $1\frac{1}{2}$	(8) $10\frac{1}{2}$	(12) $9\frac{1}{2}$	(16) 3 9	(20) 8 $9\frac{1}{2}$	(24) 15 $7\frac{1}{2}$	(28) 19 $11\frac{1}{2}$

LVI.

[illegible]

LVII.

7 r			7 r			7 r			7 r		
£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
(1) 166	19	11	(6) 377	18	6½	(11) 603	3	7½	(16) 3897	9	3½
(2) 269	15	3	(7) 885	10	5½	(12) 1236	14	6½	(17) 4908	10	4½
(3) 373	7	11½	(8) 440	9	11½	(13) 1197	15	7½	(18) 5019	11	5½
(4) 548	3	7½	(9) 225	2	0½	(14) 1229	17	7½	(19) 6100	12	6½
(5) 801	16	3½	(10) 267	19	11½	(15) 1001	19	7½	(20) 8987	13	7½

LVIII.

9 r			9 r			9 r			9 r		
£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
(1) 1697	14	1½	(6) 3456	17	8½	(11) 7898	11	9½	(16) 8001	14	0½
(2) 2597	15	2½	(7) 5678	18	9½	(12) 8396	13	10½	(17) 9876	1	1½
(3) 3147	13	3½	(8) 6095	19	7½	(13) 9879	16	3½	(18) 2098	0	10½
(4) 5379	11	7½	(9) 7876	11	0½	(14) 8080	14	7½	(19) 3117	0	0½
(5) 6017	18	8½	(10) 8809	18	11½	(15) 9091	16	10	(20) 7777	17	7½

LIX.

10 r			10 r			10 r			10 r		
£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
(1) 12345	7	8½	(9) 77801	14	8½	(17) 68901	0	9	(25) 9999	0	0½
(2) 37911	14	11	(10) 60132	15	9½	(18) 98321	1	1½	(26) 70	0	0½
(3) 51670	14	2½	(11) 37098	9	1½	(19) 35791	11	11½	(27) 123456	2	3½
(4) 63191	11	8½	(12) 49197	10	0½	(20) 98769	19	11½	(28) 357913	2	9½
(5) 76318	13	7½	(13) 87617	14	9½	(21) 17	17	11½	(29) 468024	12	9½
(6) 20108	8	4½	(14) 66091	19	10½	(22) 7071	15	7½	(30) 185299	11	11½
(7) 33127	9	5½	(15) 37790	0	10½	(23) 81129	16	8½	(31) 1001	0	1½
(8) 44238	13	6½	(16) 56789	0	7	(24) 90809	7	1½	(32) 70719	0	11½

LX.

Work the following Exercises, and test them as explained in Section XV.

£	s.	d.	£	s.	d.	£	s.	d.
(1) 0	17	9½ 14r	(10) 761	19	10½ 15r	(19) 1234	15	5½ 17r
(2) 0	18	7½ 15r	(11) 485	16	3½ 16r	(20) 4967	13	10½ 17r
(3) 0	11	9 20r	(12) 764	14	5½ 16r	(21) 3987	14	11½ 17r
(4) 2	1	3½ 13r	(13) 862	19	6½ 16r	(22) 39	17	10½ 18r
(5) 3	7	8½ 16r	(14) 1111	11	11½ 16r	(23) 162	3	9 20r
(6) 2	19	8½ 15r	(15) 3579	14	9½ 16r	(24) 357	1	1½ 20r
(7) 72	13	11½ 15r	(16) 365	19	6½ 7r	(25) 785	12	8½ 20r
(8) 365	14	8½ 15r	(17) 761	14	7½ 7r	(26) 961	17	10½ 20r
(9) 1000	6	4½ 15r	(18) 864	17	3½ 17r	(27) 987	1	7½ 20r

LXI.

6 r			6 r		
£	s.	d.	£	s.	d.
(1) 5 yds.	2 qrs.	1 nl.	(4) 66 yds.	2 qrs.	1 nl.
(2) 16 yds.	3 qrs.	3 nls.	(5) 121 yds.	2 qrs.	3 nls.
(3) 82 yds.	1 qr.	1 nl.	(6) 73 yds.	1 qr.	1 nl.

- (7) 11 yds. 1 qr. 1 nl. 1 in. (15) 92 cwts. 1 qr. 27 lbs.
 (8) 23 yds. 2 qrs. 2 nls. 2 in. (16) 1 ton 3 cwts. 3 qrs. 17 lbs. 10 oz. 9 drs.
 (9) 17 yds. 3 qrs. 2 nls. $1\frac{1}{2}$ in. (17) 17 tons 14 cwt. 1 qr. 19 lbs. 17 oz. 21 drs.
 (10) 27 yds. 2 nls. $1\frac{1}{2}$ in. (18) 16 cwts. 14 oz. 11 drs.
 (11) 5 cwts. 3 qrs. (19) 10 yds. 2 in.
 (12) 6 cwt. 2 qrs. 17 lbs. (20) 3 tons 2 qrs. 5 lbs.
 (13) 21 cwt. 1 qr. 22 lbs. (21) 5 tons 15 drs.
 (14) 35 cwt. 2 qrs. 8 lbs. (22) 7 tons 19 cwt. 2 qrs. 26 lbs.

LXII.

- 7 r (7) 29 days 17 hours 14 minutes 35 seconds.
 (1) 32 ac. 1 ro. 4 po. 3 yds. (8) 36 days 23 hours 45 minutes 47 seconds.
 (2) 19 ac. 3 ro. 16 po. 17 yds. (9) 3 yrs. 11 mo. 2 wks. 6 d. 22 h. 48 min. 48 sec.
 (3) 17 acres 12 poles 2 feet. (10) 17 yrs. 9 mo. 3 wks. 5 d. 17 h. 49 min. 59 sec.
 (4) 29 acres 1 rood 7 yards. (11) 2 years 10 months 3 weeks 2 days 17 hours.
 (5) 165 ac. 2 ro. 37 po. 27 yds. (12) 47 years 23 hours 54 seconds.
 (6) 197 ac. 3 ro. 15 po. 15 yds.

LXIII.

- 9 r (11) 6 yards 2 feet 7 inches.
 (1) 2 quarters 27 pounds 13 ounces. (12) 9 yards 1 foot 11 inches.
 (2) 3 quarters 19 pounds 11 ounces. (13) 37 yards 2 feet $5\frac{1}{2}$ inches.
 (3) 1 quarter 11 pounds 15 ounces. (14) 46 yards 2 feet 9 inches.
 (4) 3 quarters 14 ounces. (15) 83 yards 1 foot $10\frac{1}{2}$ inches.
 (5) 3 quarters 26 pounds 10 ounces. (16) 7 fur. 23 poles 5 yds. 1 ft. 10 in.
 (6) 6 acres 3 roods 19 poles. (17) 39 fur. 27 poles $2\frac{1}{2}$ yards. 3 inches.
 (7) 7 acres 1 rood 23 poles. (18) 17 fur. 31 po. 4 yds. 2 ft. 11 in.
 (8) 9 acres 2 roods 31 poles. (19) 82 fur. 36 poles $3\frac{1}{2}$ yds. 1 foot 9 in.
 (9) 14 acres 1 rood 37 poles. (20) 2 fur. 4 yds. 2 feet 11 inches.
 (10) 17 acres 3 roods 39 poles.

LXIV.

- | 10 r. | | | | | | 10 r. | | | | | | |
|-------|-------|------|------|-----|------|-------|------|-------|-------|------|------|---|
| tons | cwts. | qrs. | lbs. | oz. | drs. | qrs. | bu. | pkts. | gals. | qts. | pts. | |
| (1) | 3 | 17 | 1 | 24 | 8 | 9 | (6) | 5 | 7 | 3 | 1 | 3 |
| (2) | 84 | 16 | 3 | 19 | 15 | 6 | (7) | 7 | 6 | 2 | 0 | 2 |
| (3) | 75 | 19 | 3 | 0 | 1 | 15 | (8) | 26 | 5 | 3 | 1 | 0 |
| (4) | 47 | 0 | 1 | 27 | 0 | 14 | (9) | 0 | 0 | 3 | 1 | 1 |
| (5) | 86 | 13 | 0 | 11 | 11 | 11 | (10) | 29 | 0 | 3 | 0 | 1 |

LXV.**MISCELLANEOUS.**

- | 10 r | | 10 r | |
|------|--------------------------------|------|---|
| (1) | 5 yards 0 qrs. 2 nails 1 inch. | (6) | 2 yrs. 10 mo. 3 wks. 5 hrs. 19 sec. |
| (2) | 3 cwts. 0 qrs. 14 pounds. | (7) | 9 mls. 7 fur. 15 po. 5 yds. 2 ft. 4 in. |
| (3) | £67 19s. 11½d. | (8) | 3 pounds 9 ounces 18 dwts. 23 grs. |
| (4) | 10 acres 3 roods 26 poles. | (9) | 3 quarters 1 stone 13 pounds. |
| (5) | 7 quarters 4 bushels 3 quarts. | (10) | 2 quarters 17 pounds 13 oz. 15 drs. |

COMPOUND SUBTRACTION.

LXVI.

EXERCISES—To be worked, preparatory, by the class.

d.	d.	d.	d.	d.	d.	d.	d.	s.	d.	s.	d.
(1) $\frac{1}{2}$	(2) $\frac{2}{3}$	(3) $\frac{3}{4}$	(4) $1\frac{1}{2}$	(5) $2\frac{1}{3}$	(6) $3\frac{1}{4}$	(7) $4\frac{1}{2}$	(8) $5\frac{1}{3}$	(9) 2 8	(10) 3 $4\frac{1}{2}$		
$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$	$1\frac{1}{2}$	$2\frac{1}{3}$	$3\frac{1}{4}$	$4\frac{1}{2}$	$5\frac{1}{3}$	1 3	1 $1\frac{1}{2}$		
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>		
s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
(11) 17 $9\frac{1}{2}$	(12) 17 $5\frac{1}{2}$	(13) 18 $9\frac{1}{2}$	(14) 2 3 $4\frac{1}{2}$	(15) 67 8 $10\frac{1}{2}$							
0 $1\frac{1}{2}$	12 8	17 $10\frac{1}{2}$	1 1 $1\frac{1}{2}$	49 9 $9\frac{1}{2}$							
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>							

(The Teacher will test the answers by Section XLII.)

	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.			
(1)	40	15	3	—13	9	11	(6)	63	6	3	—45	2	9	(11)	92	0	7	—46	11	7	
(2)	77	12	5	—13	19	11	(7)	96	1	10	—59	14	8	(12)	68	1	5	—49	17	11	
(3)	80	16	2	—26	5	6	(8)	98	11	3	—25	16	11	(13)	58	2	7	—3	11	11	
(4)	95	10	0	—13	13	10	(9)	99	10	1	—35	17	7	(14)	82	14	1	—0	17	11	
(5)	120	9	5	—47	15	1	(10)	94	10	8	—39	19	10	(15)	100	0	0	—0	0	4	
	£	s.	d.	£	s.	d.		£	s.	d.	£	s.	d.		£	s.	d.		£	s.	d.
(16)	147	0	0	$\frac{1}{2}$ —	29	16	8 $\frac{1}{2}$	(26)	185	2	1	—	67	18	8 $\frac{1}{2}$						
(17)	365	1	11	—	189	16	10 $\frac{1}{2}$	(27)	477	2	0	$\frac{1}{2}$ —	107	8	3 $\frac{1}{2}$						
(18)	254	4	6	$\frac{1}{2}$ —	19	17	10 $\frac{1}{2}$	(28)	526	1	1	$\frac{1}{2}$ —	318	19	8 $\frac{1}{2}$						
(19)	689	1	0	—	391	1	7 $\frac{1}{2}$	(29)	672	0	0	—	293	4	5 $\frac{1}{2}$						
(20)	565	0	10	$\frac{1}{2}$ —	249	17	9 $\frac{1}{2}$	(30)	538	1	2	—	348	3	5 $\frac{1}{2}$						
(21)	558	13	1	$\frac{1}{2}$ —	216	4	8 $\frac{1}{2}$	(31)	680	5	1	—	382	5	8 $\frac{1}{2}$						
(22)	560	9	8	$\frac{1}{2}$ —	199	17	7 $\frac{1}{2}$	(32)	710	1	11	—	583	16	8 $\frac{1}{2}$						
(23)	663	6	1	$\frac{1}{2}$ —	311	15	10 $\frac{1}{2}$	(33)	381	5	7	$\frac{1}{2}$ —	11	11	11						
(24)	786	0	1	$\frac{1}{2}$ —	479	18	10 $\frac{1}{2}$	(34)	380	19	4	$\frac{1}{2}$ —	2	3	9 $\frac{1}{2}$						
(25)	721	2	6	—	387	15	11 $\frac{1}{2}$	(35)	980	7	2	$\frac{1}{2}$ —	583	7	11 $\frac{1}{2}$						

LXVII.

Work the following Exercises as explained in Section XVII.

Example—10 18 $2\frac{1}{2}$
6 10 $11\frac{1}{2}$

4 7 $3\frac{1}{2}$ = 2nd line subtracted from the first
 2 3 $7\frac{1}{2}$ = 3rd " " second.
 2 3 $7\frac{1}{2}$ = 4th " " third.

s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
(1) $8\frac{1}{2}$	—	$5\frac{1}{2}$	(6) 2 $2\frac{1}{2}$	—	$3\frac{1}{2}$	(11) 7 11	—	4 9	(12) 8 $5\frac{1}{2}$	—	$5 0\frac{1}{2}$
(2) $11\frac{1}{2}$	—	$6\frac{1}{2}$	(7) 3 $2\frac{1}{2}$	—	$1 11\frac{1}{2}$	(13) 8 9	—	5 3	(14) 12 1	—	7 3
(3) 1 $0\frac{1}{2}$	—	$7\frac{1}{2}$	(8) 5 $8\frac{1}{2}$	—	$3 5\frac{1}{2}$	(15) 11 $10\frac{1}{2}$	—	7 $1\frac{1}{2}$			
(4) 1 $10\frac{1}{2}$	—	1 $1\frac{1}{2}$	(9) 7 $3\frac{1}{2}$	—	$4 4\frac{1}{2}$						
(5) 1 $10\frac{1}{2}$	—	1 $1\frac{1}{2}$	(10) 6 $9\frac{1}{2}$	—	$4 0\frac{1}{2}$						

£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.				
(16)	1	8	1½	—	16	10½	(20)	2	11	11½	—	11	2½	(24)	3	15	6½	—	2	5	3½
(17)	1	14	0½	—	0	5½	(21)	2	15	8½	—	13	5½	(25)	4	19	10½	—	2	19	11½
(18)	1	18	7½	—	3	2½	(22)	3	6	0½	—	19	7½	(26)	5	17	7½	—	3	10	6½
(19)	2	3	11½	—	6	4½	(23)	3	13	0½	—	2	9½	(27)	6	18	5½	—	4	3	0½

LXVIII.

<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>£</i>	<i>s.</i>	<i>d.</i>	<i>£</i>	<i>s.</i>	<i>d.</i>								
(1)	0	10	—	6½	(8)	5	6	—	3	5½	(15)	12	10	—	8	0½	(22)	3	9	10½	—	2	3	0	
(2)	1	6	—	11½	(9)	6	2	—	3	10½	(16)	2	11½	—	1	10	(23)	3	18	3½	—	2	8	2	
(3)	1	10	—	1½	(10)	7	2	—	4	5½	(17)	8	1½	—	5	0	(24)	5	3	8½	—	3	10	10	
(4)	2	4	—	1	5½	(11)	7	6	—	4	8½	(18)	8	11½	—	5	6	(25)	6	4	10½	—	3	16	10
(5)	3	2	—	1	11½	(12)	9	6	—	5	11½	(19)	10	6½	—	6	8	(26)	8	15	9½	—	5	8	2
(6)	3	6	—	2½	(13)	10	0	—	6	8	(20)	12	5½	—	7	8	(27)	9	9	10½	—	5	16	10	
(7)	5	2	—	3	2½	(14)	14	2	—	8	10½	(21)	19	9½	—	12	2	(28)	10	3	11½	—	6	5	6

LXIX.

£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.						
(1)	17	4	3½	—	10	13	1½	(5)	26	0	2½	—	16	2	0½	(9)	186	11	0	—	115	9	8
(2)	20	19	6½	—	12	19	8½	(6)	45	15	8½	—	28	6	10½	(10)	209	17	4½	—	129	18	4½
(3)	23	7	8½	—	14	9	6½	(7)	47	0	2½	—	29	2	0½	(11)	236	18	9	—	146	6	10½
(4)	25	13	2½	—	15	17	8½	(8)	68	18	1½	—	42	13	1½	(12)	241	12	11½	—	149	5	0½

LXX.

Note—The Teacher may require the pupil, after finishing the subtraction in each exercise, to add all the lines together.

\pounds	s.	d.	
Example—2036	7	0½	
1257	14	11½	
778	12	1½	= 2nd line subtracted from the 1st.
479	2	10	= 3rd
299	9	3½	= 4th
179	13	6½	= 5th
119	15	8½	= 6th
59	17	10½	= 7th
59	17	10½	= 8th
5270	11	2	= sum of all the lines.

\pounds	s.	d.	\pounds	s.	d.	\pounds	s.	d.	\pounds	s.	d.				
(1)	1232	3	7½	—	761	1	0½	(7)	28145	16	0½	—	17384	3	5½
(2)	1473	7	4½	—	910	0	5½	(8)	31426	17	5½	—	19410	14	3½
(3)	1625	13	11	—	1004	2	1½	(9)	42765	16	9	—	26414	3	10½
(4)	1740	8	2½	—	1074	19	2½	(10)	79639	10	11	—	49189	2	7½
(5)	7715	13	11½	—	4765	11	6½	(11)	185415	8	5½	—	114521	5	9½
(6)	23899	11	1½	—	14761	9	9½	(12)	223191	3	10½	—	137853	7	8½

LXXI.

Summation verified as in Section XIII.

\pounds	s.	d.	\pounds	s.	d.	\pounds	s.	d.	\pounds	s.	d.
(1) 941	4	10½	—	581	17	2½	(7) 8585	16	10½	—	5307 12 3
(2) 1049	9	4½	—	648	15	3	(8) 25000 17	7½	—	15500 2	2½
(3) 1385	9	8½	—	856	9	7½	(9) 35368	0	8½	—	21863 17 6½
(4) 4041	8	1½	—	3054	13	9	(10) 47000	13	0½	—	29054 18 11½
(5) 5382	14	5½	—	3327	10	0½	(11) 141205	19	4½	—	87290 19 3
(6) 6507	11	9½	—	4022	17	5½	(12) 190173	8	10½	—	117561 15 3½

LXXII.

Summation to be verified as in Section XV., the lines counting upwards.

(1) 1535	14	3½	—	949	0	8½	(6) 4216	4	0	—	2605 16 11
(2) 3503	10	9½	—	2165	2	2½	(7) 8625	3	0	—	5330 16 5½
(3) 4499	8	3½	—	2780	10	8½	(8) 9208	1	0	—	5691 1 8½
(4) 7313	4	1	—	4519	7	11	(9) 19482	18	6½	—	12040 19 0
(5) 87812	8	1½	—	54266	1	10½	(10) 20200	17	1½	—	12484 13 0

LXXIII.

	qrs.	bu.	pks.	gal.	qrs.	bu.	pks.	gal.
(1) 440	7	2	0	—	272	2	3	0
(2) 1238	2	3	0	—	764	6	3	1
(3) 1010	7	3	0	—	624	3	1	1
(4) 2501	5	0	1	—	1546	3	3	0

yds.	qrs.	nls.	yds.	qrs.	nls.	yds.	qrs.	nls.	yds.	qrs.	nls.
(5) 23	1	3	—	15	2	2	(10) 947	3	0	—	585 1 2
(6) 71	0	1	—	47	1	2	(11) 2052	0	3	—	1288 2 2
(7) 104	3	1	—	69	3	2	(12) 2069	1	2	—	1279 1 0
(8) 284	3	1	—	189	3	2	(13) 4473	0	0	—	2764 2 1
(9) 250	2	3	—	155	0	3	(14) 6885	0	0	—	4255 1 1

cwts.	qrs.	lbs.	oz.	cwts.	qrs.	lbs.	oz.
(15) 28	3	23	12	—	17	1	14 4
(16) 37	3	24	13	—	22	3	3 11
(17) 86	1	3	12	—	51	3	2 4
(18) 98	3	15	15	—	59	1	9 9

tons	cwts.	qrs.	lbs.	oz.	tons	cwts.	qrs.	lbs.	oz.
(19) 71	4	3	7	0	—	44	2	0	3 0
(20) 107	1	1	21	0	—	66	5	2	17 0
(21) 148	14	1	7	0	—	92	1	0	27 0
(22) 2	7	2	5	4	—	1	9	1	13 2
(23) 4	10	3	16	14	—	2	16	0	16 3
(24) 6	8	1	24	6	—	3	19	1	10 15
(25) 13	6	3	10	0	—	8	4	3	7 0
(26) 13	12	0	2	2	—	8	8	0	1 5

	lbs.	oz.	dra.	scr.	grs.	lbs.	oz.	dra.	scr.	grs.			
(27)	33	11	1	1	2—	20	10	4	1	12			
(28)	45	2	3	2	12—	28	3	0	1	5			
(29)	153	11	5	0	12—	95	3	6	0	16			
(30)	170	6	2	2	14—	105	6	6	1	2			
	lbs.	oz.	dwts.	grs.	lbs.	oz.	dwts.	grs.					
(31)	71	0	2	12—	43	10	6	6					
(32)	110	11	6	6—	68	6	5	15					
(33)	114	0	18	12—	70	5	10	6					
(34)	151	0	13	22—	93	3	12	3					
	acres.	ro.	po.	acres.	ro.	po.	acres.	ro.	po.	acres.	ro.	po.	
(35)	199	2	3—	123	0	39	(37)	314	1	6—	194	0	19
(36)	248	3	14—	153	2	31	(38)	1085	6	4—	670	0	26
	days.	hrs.	min.	sec.	days.	hrs.	min.	sec.					
(39)	69	21	20	0—	43	4	0	0					
(40)	72	8	18	50—	44	16	25	45					

COMPOUND MULTIPLICATION.

LXXIV.

When the multiplier is under 12.

Example—Multiply £1 2s. 9½d. by 2, and £8 17s. 2½d. by 2.

£	s.	d.	£	s.	d.	Test	£	s.	d.
1	2	9½	8	17	2½		2	5	6½
		2			2		17	14	5½
2	5	6½	17	14	5½		20	0	0

Multiply each of the following couplets by 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, multiplying them *all* first by 2, then *all* by 3, then *all* by 4, &c.

<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	£	<i>s.</i>	<i>d.</i>	£	<i>s.</i>	<i>d.</i>	
(1)	2	3	and 17	9	(6)	1	1½ and 18	10½	(11)	4	5	9 and 5	14	3
(2)	3	4	and 16	8	(7)	2	2½ and 17	9½	(12)	2	3	10½ and 7	16	1½
(3)	5	6	and 14	6	(8)	4	5½ and 15	6½	(13)	3	4	11½ and 6	15	0½
(4)	6	7	and 13	5	(9)	6	8½ and 13	3½	(14)	4	5	0½ and 5	14	11½
(5)	7	8	and 12	4	(10)	7	9½ and 12	2½	(15)	5	6	1½ and 4	13	10½

LXXV.

When the multiplier is resolvable into factors.

Example—Multiply £6 7s. 2½d. and £3 12s. 9½d. by 48.

£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
6	7	2½	3	12	9½	6	7	2½	3	12	9½
		12			12			6			8
76	6	9	43	13	3	38	3	4½	29	2	2
		4			4			8			6
305	7	0	174	13	0	305	7	0	174	13	0

Multiply each of the following couplets by 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 36, 40, 44, 48, 54, 60, 63, 72, 81, 96.

$\begin{array}{r} s. \ d. \\ (1) \ 6 \ 1 \& 13 \ 11 \end{array}$	$\begin{array}{r} s. \ d. \\ (6) \ 2 \ 6 \& 17 \ 6 \end{array}$	$\begin{array}{r} s. \ d. \\ (11) \ 1 \ 2 \& 18 \ 9 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (16) \ 6 \ 7 \& 13 \ 4 \frac{1}{2} \end{array}$
$\begin{array}{r} s. \ d. \\ (2) \ 7 \ 2 \& 12 \ 10 \end{array}$	$\begin{array}{r} s. \ d. \\ (7) \ 17 \ 7 \& 2 \ 5 \end{array}$	$\begin{array}{r} s. \ d. \\ (12) \ 2 \ 3 \& 17 \ 8 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (17) \ 7 \ 8 \& 12 \ 3 \frac{1}{2} \end{array}$
$\begin{array}{r} s. \ d. \\ (3) \ 13 \ 3 \& 6 \ 9 \end{array}$	$\begin{array}{r} s. \ d. \\ (8) \ 13 \ 8 \& 6 \ 4 \end{array}$	$\begin{array}{r} s. \ d. \\ (13) \ 3 \ 4 \& 16 \ 7 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (18) \ 8 \ 9 \& 11 \ 2 \frac{1}{2} \end{array}$
$\begin{array}{r} s. \ d. \\ (4) \ 14 \ 4 \& 5 \ 8 \end{array}$	$\begin{array}{r} s. \ d. \\ (9) \ 12 \ 9 \& 7 \ 3 \end{array}$	$\begin{array}{r} s. \ d. \\ (14) \ 4 \ 5 \& 15 \ 6 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (19) \ 9 \ 10 \& 10 \ 1 \frac{1}{2} \end{array}$
$\begin{array}{r} s. \ d. \\ (5) \ 3 \ 5 \& 16 \ 7 \end{array}$	$\begin{array}{r} s. \ d. \\ (10) \ 16 \ 10 \& 3 \ 2 \end{array}$	$\begin{array}{r} s. \ d. \\ (15) \ 5 \ 6 \& 14 \ 5 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (20) \ 10 \ 11 \& 9 \ 0 \frac{1}{2} \end{array}$
$\begin{array}{r} s. \ d. \\ (21) \ 6 \ 7 \ 2 \& 3 \ 12 \ 9 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (26) \ 16 \ 15 \ 3 \& 83 \ 4 \ 8 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (31) \ 56 \ 17 \ 8 \frac{1}{2} \& 43 \ 2 \ 3 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (32) \ 78 \ 19 \ 11 \& 21 \ 0 \ 0 \frac{1}{2} \end{array}$
$\begin{array}{r} s. \ d. \\ (22) \ 3 \ 19 \ 11 \& 6 \ 0 \ 0 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (27) \ 17 \ 2 \ 9 \frac{1}{2} \& 82 \ 17 \ 2 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (32) \ 78 \ 19 \ 11 \& 21 \ 0 \ 0 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (33) \ 37 \ 17 \ 7 \& 62 \ 2 \ 4 \frac{1}{2} \end{array}$
$\begin{array}{r} s. \ d. \\ (23) \ 4 \ 0 \ 10 \& 5 \ 19 \ 1 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (28) \ 29 \ 13 \ 4 \frac{1}{2} \& 70 \ 6 \ 7 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (33) \ 37 \ 17 \ 7 \& 62 \ 2 \ 4 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (34) \ 44 \ 14 \ 4 \& 55 \ 5 \ 7 \frac{1}{2} \end{array}$
$\begin{array}{r} s. \ d. \\ (24) \ 5 \ 3 \ 9 \frac{1}{2} \& 4 \ 16 \ 2 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (29) \ 81 \ 0 \ 9 \& 18 \ 19 \ 2 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (34) \ 44 \ 14 \ 4 \& 55 \ 5 \ 7 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (35) \ 66 \ 16 \ 0 \frac{1}{2} \& 33 \ 3 \ 11 \frac{1}{2} \end{array}$
$\begin{array}{r} s. \ d. \\ (25) \ 7 \ 2 \ 7 \& 2 \ 17 \ 4 \frac{1}{2} \end{array}$	$\begin{array}{r} s. \ d. \\ (30) \ 42 \ 14 \ 8 \frac{1}{2} \& 57 \ 5 \ 3 \frac{1}{2} \end{array}$		

Multiply each of the above by 100, 110, 120, 121, 132, 144, using two factors, and by 112, 144, 162, 420, 441, 504, using three factors.

LXXVI.

When the multiplier cannot be reduced to factors

Example—Multiply £67 3s. 5½d. and £32 16s. 6½d. by 47.

$\begin{array}{r} \pounds \ s. \ d. \\ 67 \ 3 \ 5 \frac{1}{2} \times 3 \\ \hline 268 \ 13 \ 9 \\ 11 \\ \hline 2955 \ 11 \ 3 \\ 201 \ 10 \ 3 \frac{1}{2} \\ \hline 3157 \ 1 \ 6 \frac{1}{2} \end{array}$	$\begin{array}{r} \pounds \ s. \ d. \\ 32 \ 16 \ 6 \frac{1}{2} \times 5 \\ \hline 196 \ 19 \ 4 \frac{1}{2} \\ 7 \\ \hline 1378 \ 15 \ 7 \frac{1}{2} \\ 164 \ 2 \ 9 \frac{1}{2} \\ \hline 1542 \ 18 \ 5 \frac{1}{2} \end{array}$	Multiply each of the following couplets by 29, 19, 31, 34, 43, 67, 76, 83, 91, 61, 97, 111, 113, 127, 131, 143, 139, 174, 221, 234, 345, 461, 783, 199, 605, 303, 777, 811, 579, 631, 982, 867, 888, 903, 911, 601, 3213, 5017, 1961, 5682, 6789, 9876, 8899
$\begin{array}{r} \pounds \ s. \ d. \\ (1) \ 223 \ 4 \ 10 \text{ and } 776 \ 15 \ 2 \\ (2) \ 237 \ 5 \ 11 \frac{1}{2} \text{ and } 782 \ 14 \ 0 \frac{1}{2} \\ (3) \ 732 \ 3 \ 9 \frac{1}{2} \text{ and } 267 \ 16 \ 2 \frac{1}{2} \\ (4) \ 377 \ 5 \ 6 \frac{1}{2} \text{ and } 622 \ 14 \ 5 \frac{1}{2} \\ (5) \ 760 \ 14 \ 6 \frac{1}{2} \text{ and } 239 \ 5 \ 5 \frac{1}{2} \end{array}$	$\begin{array}{r} \pounds \ s. \ d. \\ (6) \ 297 \ 15 \ 11 \frac{1}{2} \text{ and } 702 \ 4 \ 0 \frac{1}{2} \\ (7) \ 369 \ 3 \ 3 \frac{1}{2} \text{ and } 630 \ 16 \ 8 \frac{1}{2} \\ (8) \ 781 \ 10 \ 10 \frac{1}{2} \text{ and } 218 \ 9 \ 1 \frac{1}{2} \\ (9) \ 666 \ 16 \ 6 \frac{1}{2} \text{ and } 333 \ 3 \ 5 \frac{1}{2} \\ (10) \ 501 \ 11 \ 11 \frac{1}{2} \text{ and } 498 \ 8 \ 0 \frac{1}{2} \end{array}$	

LXXVII.

Multiply by 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 24, 64, 48, 96, 110, 144, 13, 17, 29, 34, 46, 98, 111, 247, 384, 567, 9876, each of the following couplets.

$\begin{array}{r} \text{cwts. qrs. lbs.} \\ (1) \ 13 \ 3 \ 6 \& 6 \ 0 \ 22 \end{array}$	$\begin{array}{r} \text{cwts. qrs. lbs.} \\ (2) \ 14 \ 3 \ 13 \& 5 \ 0 \ 15 \end{array}$	$\begin{array}{r} \text{cwts. qrs. lbs.} \\ (3) \ 17 \ 2 \ 11 \& 2 \ 2 \ 1 \ 17 \end{array}$	$\begin{array}{r} \text{cwts. qrs. lbs.} \\ (4) \ 9 \ 0 \ 1 \& 10 \ 3 \ 27 \end{array}$	$\begin{array}{r} \text{cwts. qrs. lbs.} \\ (5) \ 7 \ 3 \ 14 \& 12 \ 0 \ 14 \end{array}$	$\begin{array}{r} \text{cwts. qrs. lbs.} \\ (6) \ 8 \ 2 \ 24 \& 11 \ 1 \ 4 \end{array}$
$\begin{array}{r} \text{cwts. qrs. lbs. oz.} \\ (7) \ 13 \ 0 \ 1 \ 15 \& 26 \ 3 \ 28 \ 1 \end{array}$	$\begin{array}{r} \text{cwts. qrs. lbs. oz.} \\ (8) \ 22 \ 3 \ 5 \ 11 \& 17 \ 0 \ 22 \ 5 \end{array}$	$\begin{array}{r} \text{cwts. qrs. lbs. oz.} \\ (9) \ 33 \ 1 \ 14 \ 12 \& 6 \ 2 \ 13 \ 4 \end{array}$	$\begin{array}{r} \text{cwts. qrs. lbs. oz.} \\ (10) \ 27 \ 0 \ 0 \ 15 \& 12 \ 3 \ 27 \ 1 \end{array}$	$\begin{array}{r} \text{cwts. qrs. lbs. oz.} \\ (11) \ 31 \ 3 \ 15 \ 2 \& 8 \ 0 \ 12 \ 14 \end{array}$	$\begin{array}{r} \text{cwts. qrs. lbs. oz.} \\ (12) \ 29 \ 2 \ 12 \ 4 \& 10 \ 1 \ 15 \ 12 \end{array}$

	ac.	ro.	po.	yds.	ac.	ro.	po.	yds.		ac.	ro.	po.	yds.	ac.	ro.	po.	yds.		
(13)	2	3	21	16	&	7	0	18	14½	(14)	3	2	17	3	&	6	1	22	27½
(15)	5	3	24	19	&	4	0	15	11½	(16)	6	0	27	15	&	3	3	12	15½
	qrs.	bush.	pkts.	gal.	qts.	pts.	qrs.	bush.	pkts.	gals.	qts.	pts.							
(17)	1	3	3	1	3	1 and 8	5	0	0	0	1								
(18)	2	2	1	0	2	1 and 7	5	2	1	1	1								
(19)	3	5	0	1	1	1 and 6	2	3	0	2	1								
	dys.	hrs.	min.	sec.	dys.	hrs.	min.	sec.		dys.	hrs.	min.	sec.	dys.	hrs.	min.	sec.		
(20)	2	3	22	19	&	7	20	37	41	(21)	5	13	14	23	&	4	10	45	37
(22)	7	3	29	13	&	2	20	30	29	(23)	3	22	59	58	&	6	1	0	2

LXXVIII.

Take any couplet, as in the two preceding sections. Take *any* multiplier. Prefix to the couplet any two numbers whose sum is one less than the multiplier chosen. Multiply both the multiplicands thus formed by the multiplier chosen, and add the products.

Examples—(1) Take couplet (1), Section LXXVI. Take 9 as the multiplier. Prefix to the couplet 8, (= 9—1). Then multiply by 9.

£	s.	d.	£	s.	d.
5223	4	10	3776	15	2
		9			9
47009	3	6	33990	16	6
			47009	3	6
			33990	16	6
			81000	0	0 = 9 ² × 1000

(2) Take couplet (4), and 59 as multiplier. Prefix 58 and multiply as before.

£	s.	d.	£	s.	d.
40377	5	6½ × 3	18622	14	5½
		8			12
323018	4	6	223472	13	3
		7			5
2261127	11	6 = 56 times.	1117363	6	3 = 60 times.
121131	16	8½ = 3 „	18622	14	5½ = 1 time.
2382259	8	2½ = 59 „	1098740	11	9½ = 59 times.
			2382259	8	2½
			1098740	11	9½
			3481000	0	0 = 59 ² × 1000

LXXIX.

Multiply, subtract, and add, as in Section XXVIII.

- (1) £79 17s. 8½d. by 13 & 8; by 55 & 34; by 144 & 89; by 2584 & 1597.
- (2) 13 cwts. 3 qrs. 17 lbs. by 34 & 21; by 89 & 55; by 233 & 144; by 610 & 377.
- (3) 69 ac. 3 ro. 13 po. by 8 & 5; by 34 & 21; by 89 & 55; by 1597 & 987.
- (4) 279 yds. 3 qrs. 3 nls. by 55 & 34; 144 & 89; by 377 & 233; by 987 & 610.
- (5) 17 qrs. 6 bsh. 1 pk. by 89 & 55; by 233 & 144; by 610 & 377; by 1597 & 987.

COMPOUND DIVISION.

CASE I.—When the Divisor is less than 12.

Example—(1) Divide 6s. 1d. and 13s. 11d. by 2.

$$\begin{array}{r} 2 \overline{) 6 \ 1} \\ 3 \ 0\frac{1}{2} \end{array}$$

$$\begin{array}{r} 2 \overline{) 13 \ 11} \\ 6 \ 11\frac{1}{2} \end{array}$$

(2) Divide £5, 6s. 1½d. and £4, 13s. 10½d. by 5.

$$\begin{array}{r} 5 \overline{) 5 \ 6 \ 1\frac{1}{2}} \\ 1 \ 1 \ 2\frac{3}{4} \end{array}$$

$$\begin{array}{r} 5 \overline{) 4 \ 13 \ 10\frac{1}{2}} \\ 0 \ 18 \ 9\frac{1}{4} \end{array}$$

PREPARATORY EXERCISES—*To be worked by the class.*

Divide by 2, 3, 4, 5, 6, and 8.

s.	d.	s.	d.	s.	d.	s.	d.	£	s.	d.	£	s.	d.
(1)	7	2 and 12	10	(8)	12	9 and 7	3	(15)	0	5	6½ and 14	5½	
(2)	1	3 and 6	9	(9)	16	10 and 3	2	(16)	1	2	9½ and 8	17	2½
(3)	14	4 and 5	8	(10)	1	11 and 18	1	(17)	2	3	10½ and 7	16	1½
(4)	3	5 and 6	7	(11)	1	2½ and 18	9½	(18)	3	4	11½ and 6	15	0½
(5)	2	6 and 17	6	(12)	2	3½ and 17	8½	(19)	4	5	0½ and 5	14	11½
(6)	17	7 and 2	5	(13)	3	4½ and 16	7½	(20)	5	6	1½ and 4	13	10½
(7)	13	8 and 6	4	(14)	4	5½ and 15	6½	(21)	3	5	7½ and 6	14	4½

LXXX.

Answers to be tested as in Section XLII.

Divide by 2.			Divide by 3.			Divide by 4.			Divide by 5.		
£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
(1)	19	16	0	(11)	54	10	6	(21)	109	1	4
(2)	54	10	8	(12)	101	1	6	(22)	181	16	0
(3)	109	1	4	(13)	136	7	0	(23)	218	2	8
(4)	234	6	8½	(14)	324	4	6½	(24)	541	8	1
(5)	252	10	4½	(15)	378	15	6½	(25)	650	9	5
(6)	288	17	4½	(16)	351	10	0½	(26)	468	13	5
(7)	307	1	0½	(17)	433	6	0½	(27)	577	14	9
(8)	270	14	0½	(18)	515	2	6½	(28)	432	6	1
(9)	343	8	4½	(19)	542	8	0½	(29)	723	4	1
(10)	397	19	0½	(20)	406	1	0½	(30)	505	0	9
(41)	703	0	1½ ÷ 6	(48)	1729	5	8 ÷ 8	(55)	1488	17	2½ ÷ 11
(42)	1515	2	3 ÷ 6	(49)	1373	13	6 ÷ 8	(56)	3277	13	1½ ÷ 11
(43)	1890	18	4½ ÷ 6	(50)	2836	7	6½ ÷ 9	(57)	7781	14	0 ÷ 12
(44)	2206	1	5½ ÷ 7	(51)	1945	8	10½ ÷ 9	(58)	1406	0	3 ÷ 12
(45)	1513	2	5½ ÷ 7	(52)	1545	7	8½ ÷ 9	(59)	1624	4	3 ÷ 12
(46)	1201	19	3½ ÷ 7	(53)	1262	11	10½ ÷ 10	(60)	5024	4	0 ÷ 6
(47)	2521	4	6 ÷ 8	(54)	399	18	10 ÷ 11	(61)	3781	16	9 ÷ 12

LXXXI.

When the Divisor is resolvable into factors.

Example—Divide £7947, 6s. 8d. by 14.

$$\begin{array}{r}
 7\overline{)7947} \quad 6 \quad 8 \\
 \underline{2)1135} \quad 6 \quad 8 \\
 \hline
 £567, 13s. 4d.
 \end{array}$$

Answers as in Section XLII.

£	s.	d.		£	s.	d.		£	s.	d.	
(1) 7947	6	8	÷ 14	(9) 6121	3	9	÷ 20	(17) 21624	4	0	÷ 96
(2) 1640	6	11½	÷ 14	(10) 4177	9	1½	÷ 22	(18) 18544	12	3	÷ 108
(3) 4921	3	2½	÷ 14	(11) 4636	3	0¾	÷ 27	(19) 15530	3	1½	÷ 75
(4) 3924	3	1½	÷ 15	(12) 5373	8	2¾	÷ 35	(20) 25055	6	4½	÷ 121
(5) 5681	13	5½	÷ 15	(13) 18157	9	6	÷ 84	(21) 20798	11	0	÷ 144
(6) 10408	17	6	÷ 15	(14) 12818	18	2½	÷ 49	(22) 48483	12	0	÷ 128
(7) 2165	12	4	÷ 16	(15) 11390	9	3¾	÷ 63	(23) 80886	13	4	÷ 176
(8) 2927	2	4½	÷ 18	(16) 19175	10	2	÷ 56	(24) 46690	13	0	÷ 216

LXXXII.

Take any couplet in the following section—say (2). Name any number as Divisor—say 17—then prefix to the couplet (£134, 6s. 8½d. and £865, 13s. 3½d.) two numbers whose sum is one less than the Divisor chosen—say 7 and 9.

£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.			
(a) 17	9.134	6	8½	537	6	3½	17	(b) 17	7.865	13	3½			
	85								68					
	63								106					
	51								102					
	124								45					
	119								34					
	5								11					
	20								20					
	106								233					
	102								221					
	4								12					
	12								12					
	56								147					
	51								136					
	5								11					
	4								4					
	22								46					
	17								34					
	5								12					
	£	s.	d.	£	s.	d.		£	s.	d.	£	s.	d.	
(1) 123	5	7½	and	876	14	4¾		(3) 235	7	9¾	and	764	12	2½
(2) 134	6	8½	and	865	13	3½		(4) 323	8	2½	and	676	11	9¾

\pounds	$s.$	$d.$		\pounds	$s.$	$d.$		\pounds	$s.$	$d.$		\pounds	$s.$	$d.$
(5) 463	5	9½	and	536	14	2½		(8) 87652	14	6½	and	13247	5	5½
(6) 617	10	9½	and	382	9	2½		(9) 130178	8	5½	and	869821	11	6½
(7) 4711	11	3½	and	5288	8	8½		(10) 432103	17	4½	and	567896	2	7½

(See Sections LXXVI and LXXVII.)

LXXXIII.

In the following exercises, the remainders, (if any), are all divisible by 9.

\pounds	$s.$	$d.$		\pounds	$s.$	$d.$	
(1)	28	1	$11\frac{1}{2} \div 18$ and 27	(9)	3974	0	$8\frac{1}{2} \div 162$ and 171
(2)	64	15	$5\frac{1}{2} \div 36$ and 45	(10)	5221	4	$2\frac{1}{2} \div 189$ and 198
(3)	47	17	$4\frac{1}{2} \div 54$ and 63	(11)	46270	4	$2\frac{1}{2} \div 207$ and 216
(4)	103	12	$9\frac{1}{2} \div 72$ and 81	(12)	87611	4	$9\frac{1}{2} \div 261$ and 288
(5)	129	3	$0\frac{1}{2} \div 90$ and 99	(13)	133881	9	0 $\div 297$ and 306
(6)	354	10	$10\frac{1}{2} \div 108$ and 117	(14)	221492	13	$9\frac{1}{2} \div 315$ and 324
(7)	530	17	$2\frac{1}{2} \div 126$ and 135	(15)	355374	2	$9\frac{1}{2} \div 342$ and 351
(8)	1247	3	6 $\div 144$ and 153	(16)	496444	2	$10\frac{1}{2} \div 450$ and 405

\pounds	$s.$	$d.$		\pounds	$s.$	$d.$	
(17)	677	11	$6\frac{1}{2} \div 675, 738 \& 819$	(22)	3647	15	$8\frac{1}{2} \div 1908, 2007 \& 2421$
(18)	1300	19	0 $\div 999, 981 \& 918$	(23)	8511	9	$11\frac{1}{2} \div 3303, 4221 \& 6786$
(19)	1517	15	6 $\div 729, 972 \& 1026$	(24)	10943	7	$0\frac{1}{2} \div 4716, 5814 \& 7029$
(20)	1951	8	6 $\div 1242, 1323 \& 1332$	(25)	576866	16	$7\frac{1}{2} \div 5013, 8109 \& 9729$
(21)	2683	4	$2\frac{1}{2} \div 1422, 1242 \& 1818$	(26)	798359	10	$5\frac{1}{2} \div 6903, 7713 \& 98721$

LXXXIV.The Teacher will dictate a list of Divisors gradually rising in difficulty. Prefix to the following couplets two numbers whose sum is one less than the Divisor chosen, and divide *both* by the Divisor, as in Section LXXVII.

	tons	cwts.	qrs.	lbs.		tons	cwts.	qrs.	lbs.		tons	cwts.	qrs.	lbs.	oz.	drs.
(1)	532	15	3	10 and	467	4	0	18								
(2)	2732	6	1	21 and	7627	13	2	7								
(3)	5359	17	3	25 and	4640	2	0	3								
(4)	41632	4	1	13 and	58367	15	2	15								
(5)	61824	15	1	16 and	38175	4	2	12								
	tons	cwts.	qrs.	lbs.	oz.	drs.	tons	cwts.	qrs.	lbs.	oz.	drs.				
(6)	6851	6	1	27	8	0 and	3148	13	2	0	8	0				
(7)	4540	17	3	3	10	0 and	5459	2	0	24	6	0				
(8)	17642	16	1	9	3	12 and	92357	3	2	18	12	4				
	ac.	ro.	po.	yds.	ft.		ac.	ro.	po.	yds.	ft.					
(9)	372	3	20	11	2 and	627	0	19	18½	7						
(10)	2185	1	13	17	8 and	7814	2	26	12½	1						
(11)	34561	1	17	2	6 and	65438	2	22	27½	3						

In the same way exercises may be constructed *ad libitum* on all the Tables.

LXXXV.

In the following exercises, the remainders (if any) are divisible by 9.

	tons	cwts.	qrs.	lbs.	oz.	drs.	
(1)		82	0	27	3	$8 \div$	45, 81, 117 and 171
(2)		101	0	2	3	$11 \div$	54, 63, 126 and 162
(3)	118	2	1	13	15	$0 \div$	135, 243, 423 and 432
(4)	352	16	0	22	11	$15 \div$	342, 351, 450 and 405
(5)	1631	18	2	8	10	$15 \div$	621, 216, 162 and 261
(6)	31603	14	3	3	6	$4 \div$	864, 738, 981 and 837
(7)	62152	13	1	12	1	$13 \div$	135, 234, 342 and 459
(8)	81075	8	0	15	8	$11 \div$	801, 981, 936 and 873
(9)	72036	1	1	27	10	$10 \div$	765, 657, 783 and 999
(10)	53213	9	2	15	3	$3 \div$	2340, 2304, 4320 and 4302
(11)	63072	11	0	14	13	$10 \div$	3024, 5670, 5607 and 6750
(12)	80163	0	3	2	0	$7 \div$	4302, 5940, 5904 and 9045

LXXXVI.

	lbs.	oz.	dwt.	grs.		lbs.	oz.	drs.	scr.	grs.	
(1)	46	5	11	$0 \div$	18, 27 & 36	(6)	29	3	0	$0 \div$	90, 126 & 207
(2)	326	4	10	$9 \div$	126, 261 & 396	(7)	9876	1	6	$1 \div$	45, 369 & 639
(3)	541	0	13	$3 \div$	405, 504 & 630	(8)	39858	9	0	$0 \div$	72, 180 & 6300
(4)	1249	3	4	$21 \div$	117, 666 & 882	(9)	305511	0	4	$2 \div$	8702, 837 & 918
(5)	7908	7	2	$21 \div$	576, 729 & 891	(10)	117	4	0	$1 \div$	4603, 1170 & 405

LXXXVII.

	miles	fur.	po.	yds.	feet.	in.	
(1)	887	3	30	2	0	$9 \div 621,$	54 and 702
(2)	1774	7	20	4	1	$6 \div 171,$	612 and 720
(3)	2662	3	11	$\frac{1}{2}$	2	$3 \div 207,$	594 and 945
(4)	4644	3	34	1	0	$9 \div 846,$	468 and 711
(5)	59861	1	18	5	0	$0 \div 333,$	549 and 27

	dys.	hrs.	min.	sec.		dys.	hrs.	min.	sec.		
(6)	1314	0	2	$42 \div 45,$	72 & 81	(9)	32626	10	8	$24 \div 612,$	711 & 549
(7)	0	8	28	$57 \div 63,$	18 & 405	(10)	32627	22	4	$21 \div 324,$	981 & 117
(8)	1	11	55	$57 \div 27,$	135 & 315						

LXXXVIII.

	yrs.	mo.	wks.	dys.	hrs.	min.	sec.	
(1)	353	0	0	183	6	48	$48 \div$	63, 117 & 270
(2)	1278	0	0	199	10	37	$12 \div$	72, 504 & 603
(3)	0	0	19	0	5	42	$0 \div$	18, 81 & 135
(4)	3274	1	1	4	10	10	$48 \div$	324, 423 & 567
(5)	7877	6	0	4	17	34	$48 \div$	567, 675 & 756

ac.	ro.	po.	yds.		ac.	ro.	po.	yds.
(6)	275	3	7	$0 \div 171, 261 \& 612$	(9)	162	0	$5 \ 10\frac{3}{4} \div 63, 513 \& 702$
(7)	126	0	4	$5 \div 765, 567 \& 981$	(10)	90	0	$2 \ 29\frac{1}{2} \div 27, 351 \& 954$
(8)	90	0	0	$18 \div 378, 837 \& 414$	(11)	94	2	$1 \ 5\frac{3}{4} \div 36, 54 \& 99$

N.B.—The preceding Exercises are so constructed that any one of them divided by any of the Divisors given above will leave no remainder, or a remainder divisible by 9.

PRACTICE.

PRELIMINARY EXERCISES.

1. Make a Table of Aliquot Parts of a Penny, a Shilling, and a Pound.
2. In the following list of Aliquot Parts name what part each is of another denomination. Thus—What is 3s. 4d.? One sixth of a £.
3s. 4d., 2s. 6d., 10s., 3d., 4d., 6d., $1\frac{1}{2}$ d., 5s., 2s., $\frac{1}{4}$ d., 10s., 2s. 6d., 1s. 3d., 6s. 8d., 5s., 3s. 4d., 1s. 4d., 2s., 6s. 8d., 2s. 6d.

3. What part of

2/ is 1/8	5/ is 1/7	11/ is 1/11	2/ is 1/3	£2 is 5/	£4 is 8/
3/4 is 1/4	10/ is 1/3	1/ is 1/1	4/ is 1/4	£2 is 8/	£5 is 5/
6/8 is 1/8	5/ is 1/5	2/ is 1/3	5/ is 1/3	£2 is 4/	£5 is 10/
10/ is 2/8	5/6 is 5/12	9/6 is 9/12	6/ is 2/	£2 is 10/	£5 is 8/4
15/ is 5/	8/6 is 8/12	3/ is 1/4	7/6 is 2/6	£3 is 5/	£6 is 10/
12/ is 2/	1/3 is 1/5	6/ is 1/2	12/6 is 2/6	£3 is 15/	£8 is 6/
7/ is 1/7	2/ is 1/4	9/ is 4/12	£1 is 6/8	£3 is 12/	£6 is 15/
9/ is 1/9	5/ is 1/6	2/9 is 2/9	15/ is 2/6	£3 is 10/	3/4 is 1/4
8/ is 1/8	14/ is 2/4	7/6 is 7/12	£1 is 2/6	£3 is 7/6	5/ is 1/3
8/ is 2/	7/ is 1/2	10/3 is 10/12	10/ is 1/3	£3 is 6/	£7 is 7/
10/ is 3/4	3/6 is 1/2	8/6 is 8/12	4/ is 1/8	£4 is 16/	7/6 is 1/6
4/ is 1/8	3/4 is 3/8	3/9 is 1/3	7/3 is 7/12	£4 is 6/8	8/9 is 8/12

4. What is the

$\frac{1}{2}$ of 8/	$\frac{1}{3}$ of 16/	$\frac{1}{4}$ of 9/	$\frac{1}{5}$ of 5/	$\frac{1}{6}$ of 8/9	$\frac{2}{3}$ of £1	$\frac{1}{4}$ of £4	$\frac{1}{5}$ of £6
$\frac{1}{2}$ of 10/	$\frac{1}{4}$ of 18/	$\frac{1}{5}$ of 17/	$\frac{1}{6}$ of 5/	$\frac{1}{7}$ of 13/	$\frac{2}{5}$ of 5/	$\frac{1}{5}$ of £5	$\frac{1}{6}$ of £6
$\frac{2}{3}$ of £1	$\frac{2}{5}$ of 10/	$\frac{1}{6}$ of 2/3	$\frac{1}{7}$ of 5/	$\frac{1}{8}$ of 7/9	$\frac{2}{7}$ of 8/	$\frac{1}{6}$ of £5	$\frac{1}{7}$ of £6
$\frac{3}{4}$ of 3/4	$\frac{1}{2}$ of 1/	$\frac{1}{7}$ of 3/6	$\frac{1}{8}$ of 5/9	$\frac{3}{8}$ of 1/6	$\frac{1}{8}$ of £1	$\frac{1}{8}$ of £6	$\frac{1}{8}$ of £7
$\frac{4}{5}$ of 10/	$\frac{1}{5}$ of 4/	$\frac{1}{8}$ of 5/	$\frac{1}{9}$ of 7/8	$\frac{4}{9}$ of 1/	$\frac{1}{9}$ of £1	$\frac{1}{9}$ of £6	$\frac{1}{9}$ of £1

5. Give Aliquot parts for

12/	6/8	15/7½	2/10	/9	£2 5/7½
14/	12/6	17/9	3/3	/10½	£3 10/10
18/	17/6	17/4	2/2½	£1 3/9	£1 1/1½
3/	18/2	16/3	3/3½	£2 4/	£2 2/2½
6/	8/4	3/9	7/½	£3 6/	£4 4/4
8/	7/4	4/4	10/9	£5 10/	£3 7/6
7/6	9/	10/10	/5½	£7 14/	17/4½
14/4	12/8	12/3	13/6	£3 6/8	/4½
15/5	14/8	1/1½	4/2½	£2 4/8	£2 5/10½
12/2	5/7½	2/8	5/8	£2 1/1½	16/3½

LXXXIX.

The following exercises to be worked both as in Model I, and in Model II.

Calculate the price of 45 articles at 5d. and at 7d.

MODEL I.—45 @ 1d. = 3s. 9d. } 45 @ 1d. = 3s. 9d.
 45 @ 5d. = 5 times 3s. 9d. = 18s. 9d. } 45 " 7d. = 7 times 3s. 9d. £1, 6s. 3d.

MODEL II.—45 @ 5d.

45 @ 7d.

$$4d. = \frac{1}{2} \left| \begin{array}{r} 45 \\ 15 \end{array} \right|$$

$$6d. = \frac{1}{2} \left| \begin{array}{r} 45 \\ 22 \end{array} \right|$$

$$1d. = \frac{1}{2} \left| \begin{array}{r} 15 \\ 3 \end{array} \right|$$

$$\begin{array}{l} 0 = \text{price @ } 4d. \\ 9 = \text{price " } 1d. \end{array}$$

$$1d. = \frac{1}{2} \left| \begin{array}{r} 22 \\ 3 \end{array} \right|$$

$$\begin{array}{l} 6 = \text{price @ } 6d. \\ 9 = \text{price " } 1d. \end{array}$$

$$18s. 9d. = \text{price @ } 5d.$$

$$£1, 6s. 3d. = \text{price @ } 7d.$$

- | | | |
|-----------------------|------------------------|-------------------------|
| (1) 24 @ 3d. & @ 9d. | (8) 108 @ 7d. & @ 5d. | (15) 65 @ 5d. & @ 7d. |
| (2) 36 " 4d. & " 8d. | (9) 132 " 9d. & " 3d. | (16) 39 " 9d. & " 3d. |
| (3) 48 " 2d. & " 10d. | (10) 61 " 5d. & " 7d. | (17) 125 " 10d. & " 2d. |
| (4) 64 " 3d. & " 9d. | (11) 19 " 10d. & " 2d. | (18) 230 " 3d. & " 9d. |
| (5) 46 " 3d. & " 9d. | (12) 21 " 11d. & " 1d. | (19) 119 " 7d. & " 5d. |
| (6) 63 " 2d. & " 10d. | (13) 100 " 8d. & " 4d. | (20) 123 " 5d. & " 7d. |
| (7) 96 " 8d. & " 4d. | (14) 37 " 5d. & " 7d. | |

XC.

The following Exercises to be worked both as in Model III. and Model IV.

MODEL III.—89 @ 7½d.

s. d.

89 @ 4½d.

s. d.

89 @ 1d. = 7 5

89 @ 1d. = 7 5

(89 @ 7½d. = 7½ times 7/5) 7½

(89 @ 4½d. = 4½ times 7/5) 4½

$$\begin{array}{r} 3 \ 8\frac{1}{2} \\ 2 \ 11 \ 11 \\ \hline \end{array}$$

$$£2 \ 15 \ 7\frac{1}{2}$$

$$\begin{array}{r} 3 \ 8\frac{1}{2} \\ 1 \ 9 \ 8 \\ \hline \end{array}$$

$$£1 \ 13 \ 4\frac{1}{2}$$

MODEL IV.—89 @ 7½d.

89 @ 4½d.

$$6d. = \frac{1}{2} \left| \begin{array}{r} 89 \\ 44 \end{array} \right|$$

$$3d. = \frac{1}{2} \left| \begin{array}{r} 89 \\ 22 \end{array} \right|$$

$$1\frac{1}{2}d. = \frac{1}{2} \left| \begin{array}{r} 44 \\ 11 \end{array} \right|$$

$$\begin{array}{l} 6 = \text{price @ } 6d. \\ 1\frac{1}{2} = \text{price " } 1\frac{1}{2}d. \end{array}$$

$$1\frac{1}{2}d. = \frac{1}{2} \left| \begin{array}{r} 22 \\ 11 \end{array} \right|$$

$$\begin{array}{l} 3 = \text{price @ } 3d. \\ 1\frac{1}{2} = \text{price " } 1\frac{1}{2}d. \end{array}$$

$$2,0$$

$$\begin{array}{l} 5,5 \ 7\frac{1}{2} = \text{price " } 7\frac{1}{2}d. \end{array}$$

$$2,0$$

$$\begin{array}{l} 3,3 \ 4\frac{1}{2} = \text{price " } 4\frac{1}{2}d. \end{array}$$

$$£2, 15s. 7\frac{1}{2}d.$$

$$£1, 13s. 4\frac{1}{2}d.$$

- (1) 47 @ $7\frac{1}{2}d.$ & @ $4\frac{1}{2}d.$ (8) 109 @ $1d.$ & @ $11d.$ (15) 38 @ $1\frac{1}{2}d.$ & @ $10\frac{3}{4}d.$
 (2) 74 „ $9\frac{1}{2}d.$ & „ $2\frac{1}{2}d.$ (9) 49 „ $7d.$ & „ $5d.$ (16) 246 „ $1\frac{3}{4}d.$ & „ $10\frac{1}{2}d.$
 (3) 111 „ $6\frac{1}{2}d.$ & „ $5\frac{1}{2}d.$ (10) 94 „ $5\frac{3}{4}d.$ & „ $6\frac{1}{2}d.$ (17) 239 „ $3\frac{1}{2}d.$ & „ $8\frac{1}{2}d.$
 (4) 39 „ $1\frac{1}{2}d.$ & „ $10\frac{3}{4}d.$ (11) 82 „ $1\frac{1}{2}d.$ & „ $10\frac{1}{2}d.$ (18) 101 „ $5\frac{1}{2}d.$ & „ $6\frac{3}{4}d.$
 (5) 71 „ $5\frac{3}{4}d.$ & „ $6\frac{1}{2}d.$ (12) 77 „ $9\frac{1}{2}d.$ & „ $2\frac{3}{4}d.$ (19) 196 „ $7\frac{3}{4}d.$ & „ $4\frac{1}{2}d.$
 (6) 123 „ $8\frac{3}{4}d.$ & „ $3\frac{1}{2}d.$ (13) 83 „ $4\frac{1}{2}d.$ & „ $7\frac{1}{2}d.$ (20) 365 „ $8\frac{1}{2}d.$ & „ $3\frac{3}{4}d.$
 (7) 29 „ $7\frac{1}{2}d.$ & „ $4\frac{3}{4}d.$ (14) 91 „ $3d.$ & „ $9d.$ (21) 494 „ $2\frac{1}{2}d.$ & „ $9\frac{3}{4}d.$

XCI.

Example—Calculate the price of 468 articles at $16/8$ and at $3/4$.

$$\text{MODEL V.} \left\{ \begin{array}{l} \frac{468 \text{ @ } 16/8}{468 \text{ „ } £1} = £468 \\ 468 \text{ „ } 16/8 = 78 \\ 468 \text{ „ } £\frac{1}{2} = \end{array} \right\} = \frac{\quad}{£390}$$

$$\left\{ \begin{array}{l} \frac{468 \text{ @ } 3/4}{468 \text{ „ } £1} = £468 \\ 468 \text{ „ } 3/4 = \\ 468 \text{ „ } £\frac{1}{4} = \end{array} \right\} = \frac{\quad}{£468 \div 6 = £78}$$

By Model IV.

$$\begin{array}{l} 10/ = \frac{1}{2} \mid \frac{468 \text{ @ } 16/8}{156 = \text{price „ } 6/8} \\ 6/8 = \frac{1}{2} \mid \frac{234 = \text{price @ } 10/}{156 = \text{price „ } 6/8} \\ £390 = \text{price „ } 16/8 \end{array} \quad \begin{array}{l} 3/4 = \frac{1}{2} \mid \frac{468 \text{ @ } 3/4}{£78 = \text{price @ } 3/4} \end{array}$$

Calculate the price of the following articles.

- (1) 37 @ $5/$ & @ $15/$ (8) 117 @ $15/$ & @ $5/$ (15) 484 @ $7/6$ & @ $12/6$
 (2) 74 „ $4/$ „ $16/$ (9) 123 „ $17/6$ „ $2/6$ (16) 555 „ $17/6$ „ $2/6$
 (3) 85 „ $6/8$ „ $13/4$ (10) 144 „ $6/8$ „ $13/4$ (17) 585 „ $4/$ „ $16/$
 (4) 91 „ $17/6$ „ $2/6$ (11) 132 „ $2/6$ „ $17/6$ (18) 628 „ $6/8$ „ $13/4$
 (5) 84 „ $2/6$ „ $17/6$ (12) 156 „ $3/4$ „ $16/8$ (19) 714 „ $16/8$ „ $3/4$
 (6) 99 „ $13/4$ „ $6/8$ (13) 236 „ $16/8$ „ $3/4$ (20) 896 „ $16/8$ „ $3/4$
 (7) 101 „ $16/$ „ $4/$ (14) 365 „ $12/6$ „ $7/6$ (21) 999 „ $18/4$ „ $1/8$

XCII.

Calculate by any of the foregoing methods the price of the following articles.

- (1) 64 @ $4/6$ & $15/6$ (11) 396 @ $16/3$ & $3/9$ (21) 397 @ $14/7$ & $5/5$
 (2) 86 „ $6/6$ & $13/6$ (12) 693 „ $14/3$ & $6/9$ (22) 793 „ $13/11$ & $6/1$
 (3) 96 „ $8/6$ & $11/6$ (13) 369 „ $8/3$ & $11/9$ (23) 818 „ $15/1$ & $4/11$
 (4) 104 „ $13/6$ & $6/6$ (14) 571 „ $17/3$ & $2/9$ (24) 648 „ $16/11$ & $3/1$
 (5) 117 „ $11/6$ & $8/6$ (15) 715 „ $11/9$ & $8/3$ (25) 831 „ $17/5$ & $2/7$
 (6) 159 „ $8/4$ & $11/8$ (16) 840 „ $11/2$ & $8/10$ (26) 29 „ $18/8$ & $1/4$
 (7) 240 „ $4/8$ & $15/4$ (17) 901 „ $7/10$ & $12/2$ (27) 171 „ $2/10$ & $17/2$
 (8) 360 „ $12/4$ & $7/8$ (18) 909 „ $5/10$ & $14/2$ (28) 53 „ $17/2$ & $2/10$
 (9) 111 „ $7/4$ & $12/8$ (19) 777 „ $16/9$ & $3/3$ (29) 47 „ $11/11$ & $8/1$
 (10) 717 „ $15/4$ & $4/8$ (20) 1000 „ $4/7$ & $15/5$ (30) 144 „ $11/7$ & $8/5$

XCIII.

Calculate the price of the following articles:—

- (1) 127 @ $5/7\frac{1}{2}$ & $14/4\frac{1}{2}$..(11) @ $14/8\frac{1}{2}$ & $5/3\frac{1}{2}$ (21) 1224 @ $8/2\frac{1}{2}$ & $11/9\frac{1}{2}$
 (2) 134 „ $4/9\frac{1}{2}$ & $15/2\frac{1}{2}$..(12) „ $15/9\frac{1}{2}$ & $4/2\frac{1}{2}$ (22) 2345 „ $9/6\frac{1}{2}$ & $10/5\frac{1}{2}$
 (3) 261 „ $6/10\frac{1}{2}$ & $13/1\frac{1}{2}$..(13) „ $18/4\frac{1}{2}$ & $1/7\frac{1}{2}$ (23) 3589 „ $8/11\frac{1}{2}$ & $11/3\frac{1}{2}$
 (4) 395 „ $7/4\frac{1}{2}$ & $12/7\frac{1}{2}$..(14) „ $2/5\frac{1}{2}$ & $17/6\frac{1}{2}$ (24) 4619 „ $8/3\frac{1}{2}$ & $11/8\frac{1}{2}$
 (5) 655 „ $8/5\frac{1}{2}$ & $11/6\frac{1}{2}$..(15) „ $13/7\frac{1}{2}$ & $6/4\frac{1}{2}$ (25) 111 „ $16/2\frac{1}{2}$ & $3/9\frac{1}{2}$
 (6) 800 „ $9/4\frac{1}{2}$ & $10/7\frac{1}{2}$..(16) „ $11/2\frac{1}{2}$ & $8/9\frac{1}{2}$ (26) 3017 „ $4/5\frac{1}{2}$ & $15/6\frac{1}{2}$
 (7) 763 „ $10/10\frac{1}{2}$ & $9/1\frac{1}{2}$..(17) „ $3/4\frac{1}{2}$ & $16/7\frac{1}{2}$ (27) 4695 „ $11/7$ & $8/5$
 (8) 919 „ $12/2\frac{1}{2}$ & $7/9\frac{1}{2}$..(18) „ $14/6\frac{1}{2}$ & $5/5\frac{1}{2}$ (28) 5327 „ $15/3\frac{1}{2}$ & $4/11\frac{1}{2}$
 (9) 897 „ $13/8\frac{1}{2}$ & $6/3\frac{1}{2}$..(19) „ $17/10\frac{1}{2}$ & $2/1\frac{1}{2}$ (29) 4481 „ $6/7\frac{1}{2}$ & $13/4\frac{1}{2}$
 (10) 978 „ $7/10\frac{1}{2}$ & $12/1\frac{1}{2}$..(20) „ $11/4\frac{1}{2}$ & $8/7\frac{1}{2}$ (30) 5639 „ $1/8\frac{1}{2}$ & $18/3\frac{1}{2}$

XCIV.

Calculate the price of the following articles by the following method:—

Method—To the number of pounds annex half the number of shillings for a multiplier. Double the units figure of the product for shillings.

MODEL VI.—247 yards @ £4 6s. and @ £5 14s.

$$\begin{array}{r} 247 \\ 43 \\ \hline 74,1 \\ 988 \\ \hline \text{£}1062, 2s. \end{array}$$

$$\begin{array}{r} 247 \\ 57 \\ \hline 172,9 \\ 1235 \\ \hline \text{£}1407, 18s. \end{array}$$

- | £ | s. | £ | s. | £ | s. | £ | s. | £ | s. | £ | s. |
|------------|----|----|----|---|----|------------|----|----|----|---|----|
| (1) 27 @ | 3 | 4 | & | 6 | 16 | (6) 421 @ | 4 | 6 | & | 5 | 14 |
| (2) 36 „ | 4 | 8 | & | 5 | 12 | (7) 389 „ | 6 | 4 | & | 3 | 16 |
| (3) 44 „ | 2 | 6 | & | 7 | 14 | (8) 960 „ | 7 | 8 | & | 2 | 12 |
| (4) 56 „ | 6 | 2 | & | 3 | 18 | (9) 100 „ | 8 | 16 | & | 1 | 4 |
| (5) 84 „ | 7 | 8 | & | 2 | 12 | (10) 55 „ | 3 | 18 | & | 6 | 2 |
| (11) 237 @ | 7 | 18 | & | 2 | 2 | (12) 372 „ | 5 | 16 | & | 4 | 4 |
| (13) 414 „ | 4 | 14 | & | 5 | 6 | (14) 29 „ | 3 | 12 | & | 6 | 8 |
| (15) 111 „ | 2 | 10 | & | 7 | 10 | | | | | | |

XCV.

65 @ £3, 7s. and @ £6, 13s.

$$\begin{array}{r} 65 \\ 33\frac{1}{2} \\ \hline 3,2 \text{ 1} \\ 19,5 \text{ twice } 7 = 14 \\ 195 \text{ remain.} = 1 \\ \hline \text{£}217, 15s. \end{array}$$

$$\begin{array}{r} 65 \\ 66\frac{1}{2} \\ \hline 3,2 \text{ 1} \\ 39,0 \text{ twice } 2 = 4 \\ 390 \text{ remain.} = 1 \\ \hline \text{£}432, 5s. \end{array}$$

In the same way calculate the price of the following:—

- | £ | s. | £ | s. | £ | s. | £ | s. | £ | s. | £ | s. |
|------------|----|----|----|---|----|------------|----|----|----|---|----|
| (1) 423 @ | 3 | 7 | & | 6 | 13 | (6) 846 @ | 3 | 9 | & | 6 | 11 |
| (2) 346 „ | 4 | 3 | & | 5 | 17 | (7) 459 „ | 8 | 3 | & | 1 | 17 |
| (3) 642 „ | 5 | 7 | & | 4 | 13 | (8) 713 „ | 7 | 13 | & | 2 | 7 |
| (4) 741 „ | 5 | 13 | & | 4 | 7 | (9) 816 „ | 5 | 17 | & | 4 | 3 |
| (5) 684 „ | 6 | 9 | & | 3 | 11 | (10) 890 „ | 3 | 19 | & | 6 | 1 |
| (11) 563 @ | 6 | 7 | & | 3 | 13 | (12) 851 „ | 8 | 13 | & | 1 | 7 |
| (13) 754 „ | 6 | 17 | & | 3 | 3 | (14) 694 „ | 4 | 15 | & | 5 | 5 |
| (15) 359 „ | 5 | 15 | & | 4 | 5 | | | | | | |

XCVI.

Calculate the following exercises by any of the foregoing methods:—

- | | £ | s. | d. | £ | s. | d. | | £ | s. | d. | £ | s. | d. |
|-----------|---|----|----|-------|----|----|------------|---|----|----|-------|----|----|
| (1) 842 @ | 5 | 3 | 4 | and 4 | 16 | 8 | (7) 712 @ | 6 | 17 | 6 | and 3 | 2 | 6 |
| (2) 731 „ | 6 | 6 | 8 | and 3 | 13 | 4 | (8) 643 „ | 2 | 13 | 6 | and 7 | 6 | 6 |
| (3) 871 „ | 7 | 3 | 4 | and 2 | 16 | 8 | (9) 542 „ | 5 | 16 | 10 | and 4 | 3 | 2 |
| (4) 659 „ | 4 | 12 | 6 | and 5 | 7 | 6 | (10) 359 „ | 5 | 12 | 9 | and 4 | 7 | 3 |
| (5) 812 „ | 2 | 17 | 6 | and 7 | 2 | 6 | (11) 654 „ | 4 | 17 | 4 | and 5 | 2 | 8 |
| (6) 854 „ | 8 | 7 | 6 | and 1 | 12 | 6 | (12) 812 „ | 6 | 12 | 11 | and 3 | 7 | 1 |

XCVII.

- | | £ | s. | d. | £ | s. | d. | | £ | s. | d. | £ | s. | d. |
|----------|---|----|----|-------|----|----|-----------|---|----|-----|-------|----|----|
| (1) 36 @ | 3 | 5 | 9½ | and 6 | 14 | 2½ | (7) 65 @ | 6 | 12 | 10½ | and 3 | 7 | 1½ |
| (2) 48 „ | 2 | 7 | 5 | and 7 | 12 | 7 | (8) 78 „ | 4 | 4 | 8½ | and 5 | 15 | 3½ |
| (3) 38 „ | 4 | 15 | 7½ | and 5 | 4 | 4½ | (9) 69 „ | 5 | 18 | 2½ | and 4 | 1 | 9½ |
| (4) 50 „ | 5 | 11 | 10 | and 4 | 8 | 2 | (10) 92 „ | 7 | 11 | 9½ | and 2 | 8 | 2½ |
| (5) 62 „ | 8 | 3 | 4½ | and 1 | 16 | 7½ | (11) 87 „ | 6 | 16 | 11½ | and 3 | 3 | 0½ |
| (6) 71 „ | 3 | 3 | 3½ | and 6 | 16 | 8½ | (12) 91 „ | 4 | 0 | 10 | and 5 | 19 | 2 |

XCVIII.

- | | | | | | | | | | | | | | |
|-----------|---|----|-----|-------|----|----|------------|---|---|-----|-------|----|-----|
| (1) 85 @ | 6 | 6 | 6½ | and 3 | 13 | 5½ | (7) 117 @ | 4 | 2 | 5½ | and 5 | 17 | 6½ |
| (2) 69 „ | 7 | 17 | 9½ | and 2 | 2 | 2½ | (8) 132 „ | 7 | 7 | 9½ | and 2 | 12 | 2½ |
| (3) 96 „ | 8 | 13 | 11 | and 1 | 6 | 1 | (9) 145 „ | 6 | 8 | 5½ | and 3 | 11 | 6½ |
| (4) 93 „ | 3 | 2 | 11½ | and 6 | 17 | 0½ | (10) 189 „ | 8 | 3 | 10½ | and 1 | 16 | 1½ |
| (5) 101 „ | 5 | 17 | 8½ | and 4 | 2 | 3½ | (11) 198 „ | 1 | 1 | 1½ | and 8 | 18 | 10½ |
| (6) 113 „ | 1 | 9 | 6½ | and 8 | 10 | 5½ | (12) 183 „ | 3 | 5 | 7 | and 6 | 14 | 5 |

SIMPLE PROPORTION.**PRELIMINARY EXPLANATIONS.**

Ratio is the relation which one quantity bears to another with respect to magnitude (size). Thus, as 4 is the half of 8, the ratio of 4 to 8 is one half. Proportion is the equality of ratios. Thus, 4 is to 8 as 5 is to 10.

The ratio of 4 to 8 is written thus, 4 : 8

„ 5 to 10 „ 5 : 10

And the proportion is written thus 4 : 8 :: 5 : 10.

The figures 4, 8, 5, and 10 are called the terms of the proportion, thus, 4 is the first term, 8 the second, 5 the third, and 10 the fourth.

The product of the first and fourth terms = product of the second and third terms. This term is called an equation, and may be written thus,

$$(a) \text{ 1st term } \times \text{ 4th term } = (b) \text{ 2nd term } \times \text{ 3rd term.}$$

By dividing (a) and (b) by 1st term.

$$\text{4th term} = \frac{\text{2nd term} \times \text{3rd term}}{\text{1st term.}}$$

XCIX.

Find the fourth term in each of the following proportions.

2 : 4 :: 5 :	7 : 14 :: 26 :	123 : 369 :: 27 :
3 : 6 :: 7 :	5 : 20 :: 1 :	324 : 234 :: 642 :
5 : 10 :: 9 :	1 : 19 :: 133 :	513 : 315 :: 711 :
1 : 3 :: 7 :	8 : 4 :: 12 :	324 : 243 :: 810 :
3 : 9 :: 12 :	9 : 3 :: 21 :	385 : 407 :: 792 :
5 : 8 :: 40 :	10 : 100 :: 37 :	$4\frac{1}{2}$: 18 :: 36 :
7 : 21 :: $33\frac{1}{3}$:	12 : 3 :: 84 :	14 : $3\frac{1}{2}$:: 64 :

As we can only compare the size of things that are measured by the same standard, a ratio can only exist between two things of the same kind, and, consequently, the first and second terms must be of the same name, and, of course, the third and fourth must be of the same name.

When the first and second terms given are not both of the same name they must be reduced. The fourth term is always the same as the third term. When the third term consists of several denominations it is generally reduced to the lowest mentioned, and the quotient arising from dividing this by the first term will, of course, be of the same name.

C.

Given by the Teacher, any three of the following terms, the Pupil to find the fourth

- (1) 17 yds. : 221 yds. :: 1s. $8\frac{1}{2}d.$: £1, 1s. $11\frac{1}{2}d.$
- (2) 13 yds. : 143 yds. :: 3s. $4\frac{1}{2}d.$: £1, 17s. $1\frac{1}{2}d.$
- (3) 100 yds. : 160 yds. :: 8s. $5\frac{1}{2}d.$: 13s. 6d.
- (4) 39 yds. : 432 yds. :: £1, 1s. $11\frac{1}{2}d.$: £12, 3s.
- (5) 3s. $4\frac{1}{2}d.$: £1, 17s. $1\frac{1}{2}d.$:: 17 yds. : 187 yds.
- (6) 8s. $5\frac{1}{2}d.$: 13s. 6d. :: 50 yds. : 80 yds.
- (7) 13s. 6d. : £2, 17s. $4\frac{1}{2}d.$:: 68 yds. : 289 yds.
- (8) 15s. $2\frac{1}{2}d.$: £2, 0s. 6d. :: 51 cwts. : 136 cwts.
- (9) £13, 18s. $5\frac{1}{2}d.$: £95, 8s. $6\frac{3}{4}d.$:: 165 tons : 1131 tons.
- (10) £14, 6s. $10\frac{1}{2}d.$: £23, 4s. $0\frac{3}{4}d.$:: 34 cwts. : 55 cwts.
- (11) £37, 10s. $11\frac{1}{2}d.$: £60, 15s. :: 89 dys. : 144 dys.
- (12) £8, 12s. $1\frac{1}{2}d.$: £58, 19s. $6\frac{3}{4}d.$:: 34 yrs. : 233 yrs.
- (13) £98, 5s. $11\frac{1}{2}d.$: £1277, 17s. $2\frac{1}{2}d.$:: 2 yrs. : 26?
- (14) £294, 17s. $9\frac{3}{4}d.$: £491, 9s. $8\frac{1}{2}d.$:: 51 tons : 85?
- (15) 13 cwts. : 21 cwts. :: £1277, 17s. $2\frac{1}{2}d.$: £2084, 4s. $8\frac{1}{2}d.$
- (16) 10 cwts. 3 qrs. 11 lbs. : 18 cwts. 0 qrs. 9 lbs. :: £3 : £5.
- (17) 7 cwts. 0 qrs. 26 lbs. : 10 cwts. 3 qrs. 11 lbs. :: £2, 7s. $7\frac{1}{2}d.$: £3, 11s. $5\frac{1}{2}d.$
- (18) 9 cwts. 1 qr. 17 lbs. : 15 cwts. 0 qrs. 21 lbs. :: £9, 5s. 3d. : £14, 19s. 3d.
- (19) 2 cwts. 0 qrs. 19 lbs. : 3 cwts. 2 qrs. 13 lbs. :: £183, 15s. 3d. : £306, 5s. 5d.
- (20) £190, 17s. $1\frac{1}{2}d.$: £286, 5s. $8\frac{1}{2}d.$:: 4 cwts. 1 qr. 10 lbs. : 6 cwts. 2 qrs. 1 lb.
- (21) £63, 12s. $4\frac{1}{2}d.$: £95, 8s. $6\frac{3}{4}d.$:: 7 cwts. 0 qrs. 26 lbs. : 10 cwts. 3 qrs. 11 lb.

- (22) £477, 2s. 9½d. : £763, 8s. 6d. : : 18 cwts. 0 qrs. 9 lbs. : 1 ton 8 cwts. 3 qrs. 20 lbs.
- (23) £159, 0s. 11½d. : £254, 9s. 6d. : : 3 cwts. 2 qrs. 13 lbs. : 5 cwts. 3 qrs. 4 lbs.
- (24) 16s. 10½d. : £1, 5s. 3¾d. : : 10 oz. 2 drs. : 15 oz. 3 drs. (Avoird.)
- (25) £2, 2s. 2½d. : £3, 7s. 6d. : : 1 lb. 9 oz. 5 drs. : 2 lbs. 8 oz. 8 drs.
- (26) £5, 9s. 8½d. : £8, 17s. 2½d. : : 4 lbs. 1 oz. 13 drs. : 6 lbs. 10 oz. 5 drs.
- (27) £14, 6s. 10½d. : £23, 4s. 0¾d. : : 10 lbs. 12 oz. 2 drs. : 17 lbs. 6 oz. 7 drs.
- (28) £13, 18s. 5½d. : £22, 10s. 6¾d. : : 17 lbs. 6 oz. 7 drs. : 1 qr. 0 lbs. 2 oz. 9 drs.
- (29) £80, 15s. : £37, 10s. 11½d. : : 1 qr. 17 lbs. 9 oz. : 1 qr. 0 lbs. 2 oz. 9 dr.
- (30) 10 oz. 2 drs. : 1 lb. 9 oz. 5 drs. : : 10s. 1½d. : £1, 5s. 3¾d.
- (31) 15 oz. 3 drs. : 2 lbs. 8 oz. 8 drs. : : 15s. 2½d. : £2, 0s. 6d.
- (32) 2 oz. 3 dwts. 21 grs. : 4 oz. 7 dwts. 18 grs. : : £1, 2s. 9½d. : £2, 5s. 7d.
- (33) 6 oz. 11 dwts. 15 grs. : 10 oz. 19 dwts. 9 grs. : : 5s. 0¾d. : 8s. 5½d.
- (34) 1 lb. 5 oz. 11 dwts. 0 grs. : 2 lbs. 4 oz. 10 dwts. 9 grs. : : 13s. 6d. : £1, 1s. 11½d.
- (35) 16 lbs. 3 oz. 4 dwts. 21 grs. : 10 lbs. 13 dwts. 3 grs. : : £7, 10s. 2½d. : £4, 12s. 9¾d.
- | | ac. | ro. | po. | ac. | ro. | po. | £ | s. | d. | £ | s. | d. | | |
|------|-----|-----|-----|-----|-----|-----|---|------|----|----|----|-----|----|-----|
| (36) | 9 | 2 | 38 | 14 | 2 | 17 | : | 2 | 2 | 3 | : | 3 | 3 | 4½ |
| (37) | 2 | 2 | 16 | 3 | 3 | 24 | : | 4 | 7 | 6½ | : | 6 | 11 | 3¾ |
| (38) | 38 | 3 | 32 | 24 | 1 | 15 | : | 17 | 10 | 2 | : | 10 | 18 | 10½ |
| (39) | 27 | 1 | 8 | 16 | 3 | 24 | : | 22 | 3 | 7½ | : | 13 | 14 | 7½ |
| (40) | 102 | 0 | 39 | 165 | 2 | 6 | : | 45 | 19 | 2½ | : | 74 | 8 | 2½ |
| (41) | 793 | 0 | 0 | 71 | 2 | 0 | : | 1335 | 0 | 2½ | : | 120 | 7 | 4¾ |
- (42) 7 yds. 3 qrs. 2 nls. : 19 yds. 2 qrs. 3 nls. : : £5, 14s. 9½d. : £14, 6s. 11¾d.
- (43) 11 yds. 3 qrs. 1 nl. : 31 yds. 2 qrs. : : £19 : £50, 13s. 4d.
- (44) 51 yds. 0 qrs. 3 nls. : 133 yds. 3 qrs. 2 nls. : : £82, 6s. 8d. : £215, 6s. 8d.
- (45) £2387, 13s. 4d. : £912 : : 1484 yds. 1 qr. 3 nls. : 567 yds.
- (46) £37, 6s. 1¾d. : £1750, 11s. 5½d. : : 51 yds. 3 nls. : 2401 yds. 3 qrs. 2 nls.
- (47) 17 yds. 2 qrs. 1 nl. : 35 yds. 2 nls. : : 3 yds. 3 qrs. 3 nls. : 7 yds. 3 qrs. 2 nls.
- (48) 7 qrs. 5 bu. 2 pks. : 53 qrs. 6 bu. 2 pks. : : £6, 16s. 9d. : £47, 17s. 3d.
- (49) 12 qrs. 6 bu. 2 pks. : 87 qrs. 1 bu. : : £7, 15s. 6½d. : £52, 17s. 6½d.
- (50) 140 qrs. 7 bu. 2 pks. : 20 qrs. 4 bu. : : £85, 10s. 8¾d. : £12, 8s. 10d.
- (51) £11, 7s. 11d. : £18, 4s. 8d. : : 88 qrs. 4 bu. 3 pks. : 141 qrs. 6 bu.
- (52) £138, 8s. 3½d. : £223, 19s. : : 228 qrs. 0 bu. 2 pks. : 369 qrs.
- (53) 1 oz. : 1 ton : : 1½d. : £186, 13s. 4d.
- (54) 2 oz. : 3 tons : : 2½d. : £560.
- (55) 5 oz. : 8 tons : : 6½d. : £1493, 6s. 8d.
- (56) 13 oz. : 89 tons. : : 1s. 4½d. : £16613, 6s. 8d.
- (57) 2 days : 3 years : : 4s. 6½d. : £124, 6s. 6¾d.
- (58) 13 years : 3 wks. : : £538, 15s. 1½d. : £2, 7s. 8½d.
- (59) £9656, 3s. 0½d. : £42, 16s. 1½d. : : 233 yrs. : 1 yr. 12 dys.
- (60) 6 wks. : 68 yrs. : : £4, 15s. 4½d. : £2810, 7s. 8d.

The Exercises in the Sequel are Self-Testing. See Sections 41, 42, and 45.

SIMPLE ADDITION.

(1) John and James went out a fishing. John caught eleven trouts and James sixteen. They put them into one basket. How many did it contain?

(2) Edward, in going to school one day, met three flocks of geese. In the first he counted nineteen; in the second twenty-three; and in the third thirty. How many did he meet?

(3) In a railway train there were fifty-seven First Class, twenty-five Second Class, and one hundred and eighty-eight Third Class Passengers. How many were there in all?

(4) An omnibus left Musselburgh one morning with thirteen passengers for Edinburgh, five more went in at Joppa, and nine at Portobello; how many were booked in all?

(5) In a school there are thirty-eight boys in the first class, in the second twenty-nine, in the third seventeen, and in the fourth fifteen. How many boys are there altogether?

(6) In a church there are eight hundred and thirty-six sittings in the area, in each of the side galleries one hundred and fifty, and in the front gallery one hundred and eighty-seven. How many sittings does it contain?

(7) How many times does a clock strike in three days?

(8) A man was born in eighteen hundred and one. When is he sixty-two years of age?

(9) In one class-room were seventy-nine boys and fifty-seven girls; in another, thirty-seven girls and forty-nine boys; and in another, one hundred and one boys and ninety-one girls. How many boys were there? How many girls? And how many children altogether?

(10) I wish to know the number of animals that crossed the bridge. There were two thousand and fifty-three sheep; one thousand one hundred and ninety oxen; one thousand two hundred and seventeen horses; five hundred and thirteen dogs; thirteen donkeys, and forty-five pigs.

(11) From a return issued January 1863, it appears that the total number of locomotives at work on the Railways in England and Wales is four thousand nine hundred and fifty-six, in Scotland eight hundred and forty-eight, and in Ireland three hundred and fifty-two. Required the total number.

(12) At a Parliamentary election there were four candidates, who received respectively seven hundred and one, six hundred and thirteen, two hundred and ninety-seven, and two hundred and thirty-four votes. How many electors voted?

(13) A boy was engaged for one week on the following terms: on Monday he was to receive one penny, and every day thereafter his wages were to be increased by twopence. What would be his wages for the week?

(14) At an election the successful candidate had a majority of nine votes, his opponent had forty-five votes. Required the number who voted.

(15) In a three-storeyed house there are three windows in each storey, containing respectively, four, six, and eight panes. How many panes are there in all?

(16) In a house of four storeys there were in the first flat seven men, thirteen women, and twenty-seven children; in the second there were respectively five, nine, and fourteen; in the third six, eight, and twelve; in the fourth nine, six, and nineteen. How many men were there? How many women? How many children? And how many in all?

(17) A book-case has five shelves; in the first there are twenty-four books, in the second thirty-six, in the third as many as in the first and second, in the fourth fifteen more than in the third, and in the fifth twelve more than in the second. How many books does it contain?

- (18) Add the even numbers up to sixteen.
- (19) Add the odd numbers from three to fifteen (inclusive).
- (20) Show that $27 + 19 + 83 = 19 + 14 + 63 + 33$.
- (21) Show that $16 + 3 + 80 + 112 + 4 = 19 + 32 + 41 + 96 + 27$.
- (22) Show that $130 + 310 + 3 + 3309 + 7898 = 1231 + 19 + 685 + 9715$.
- (23) How many days from 5th November till 3rd February?
- (24) How many days from 17th May till 4th November?
- (25) How many days from 2nd August 1862, till 7th September 1863?
- (26) There are thirty-three Counties in Scotland, forty in England, twelve in Wales, and thirty-two in Ireland. How many are in the British Islands?

SIMPLE SUBTRACTION.

- (1) In a mixed school there are one hundred and nineteen children present, of these seventy-four are girls. How many boys are there?
- (2) In a school of one hundred and fifty-seven children, there are forty-nine in the play-ground. How many are there in the school-room?
- (3) In the year 1863 a man is twenty-seven years of age. When was he born?
- (4) How many years did the Rebellion of 1715 break out after the Revolution (1688)?
- (5) Six hundred and forty-eight years ago (1863) Magna Charta was passed. What is the date?
- (6) Give the ages of the following Writers, Burnet (b. 1643, d. 1715); Collins (b. 1720, d. 1756). Locke (b. 1632, d. 1704).
- (7) Oliver Goldsmith died in 1774 at the age of 46. When was he born?
- (8) At an election 335 persons voted for Mr. Brown, and 236 for Mr. Smith. What was the majority?
- (9) Three hundred and thirteen sheep were grazing in a field, but next day only two hundred and five could be counted. How many were stolen or strayed?
- (10) Of six thousand four hundred and thirty-five killed and wounded in a battle, one thousand and eighty-nine were killed. How many were wounded?
- (11) At Campsie Junction a train arrived with one hundred and fifty-nine passengers, of whom eighty-seven went east. How many went west?
- (12) A farmer set out with four hundred and sixty cattle for the market, he sold thirty-eight on the road, and bought ten. How many had he then?
- (13) In a summary of the religions found in Europe out of a population of two hundred and seventy-six millions, there are of Hebrews two millions, of Mahomedans nine millions, of Protestants fifty-six millions, of the Greek Church sixty-five millions, and the remainder Roman Catholics. How many are there of the latter?
- (14) How much does 847684537 exceed 371547682?
- (15) A person eighty-two years of age was thirty-seven years old at the birth of his eldest son. What is his son's age?
- (16) From thirty-two thousand three hundred and one subtract the sum of the digits.
- (17) How much does one million exceed 761356?
- (18) A man bought a horse, a gig, and a set of harness for £54; the price of the horse and gig was £45, and the price of the horse and harness was £27. Find the price of each.
- (19) A train left Edinburgh for Musselburgh with one hundred and seventeen passengers, of these there were booked for Portobello and Joppa fifty-

four, and for Musselburgh and Portobello ninety-nine. How many were booked for each station?

(20) From the sum of thirteen thousand two hundred and fifty-seven, and nine thousand three hundred and sixty-nine, subtract their difference.

(21) From the sum of 321003 and 99099, subtract their difference.

(22) To the sum of 8631 and 3168 add their difference, and from that subtract 8631 (the greater).

(23) To the sum of 43452 and 71037 add their difference, and from that subtract 71037 (the greater).

(24) From the sum of 108 and 72 subtract their difference, and from that subtract 72 (the less).

(25) From the sum of 80730 and 357318 subtract their difference, and from that subtract 80730 (the less).

(26) From the preceding give a short method of finding any two numbers whose sum and difference are given.

(27) The sum of two numbers is 45 and their difference 9. Find the numbers.

(28) Find two numbers whose sum is 81 and difference 45.

(29) Shew that $16 + 45 + 11 - 19 - 23 - 29 = 1$.

(30) Shew that $13 + 17 + 93 - 64 - 14 = 95 - 18 - 32$.

(31) Shew that $165 - 29 + 18 - 37 = 513 - 74 - 38 + 11 - 344 + 49$.

(32) Shew that $806951 - 311 + 1869 - 63256 = 1000000 - 254747$.

(33) From the difference of *one* and *one thousand*, subtract the difference of *one* and *one hundred*.

(34) How much does the difference of *ninety-nine* and *one million* exceed one hundred and ninety-nine?

SIMPLE MULTIPLICATION.

(1) A house has nine windows and twelve panes in each window. How many panes are there?

(2) A cheese weighs forty-five pounds. What is the weight of nineteen such?

(3) How many yards are in 9117 pieces of cloth, each piece containing 27 yards?

(4) Sound travels at the rate of one thousand one hundred and twenty-five feet per second. What is the rate per hour?

(5) A flash of lightning is seen twelve seconds before the thunder is heard. What is the distance from the cloud in which the explosion occurred?

(6) There are one hundred and thirty-five houses in a village, and each house contains on an average five persons. What is the population of the village?

(7) On the road to school I met thirty-five sheep, eighteen oxen, nineteen geese, and one turkey. How many feet were there among them all?

(8) In a flock of three thousand four hundred and twenty sheep, how many legs?

(9) A swallow flies at the rate of fifty miles an hour. What distance will it fly in nine hours?

(10) A ploughman walks eight miles in ploughing an acre of land. What distance will he travel in ploughing twenty-seven acres?

(11) A pound of wool will furnish a piece of yarn one hundred miles in length. What length will thirty-six pounds furnish?

(12) A fleet consisted of three ships of ninety-eight guns each, five of sixty-three guns, nine of thirty-two guns, and two frigates of sixty guns each. How many guns were there altogether?

(13) A book contains two hundred and sixty-six pages, eighteen lines in each page, and twelve words in each line. How many words are in the book?

(14) The common thistle produces twenty-four thousand seeds. How many seeds will be produced by fifty-four thistles?

(16) How many times does the pendulum of a clock vibrate in a day?

(15) A company of soldiers were drawn up in the form of a square with nineteen on one side. How many were in the company?

(17) A railway guard is engaged on a train that runs between Glasgow and Hamilton nine times a day. How many miles does he travel—the distance being eight miles?

(18) A train leaving Edinburgh and going for three hours at the rate of twenty-four miles an hour—then for three hours at the rate of fifteen miles an hour—then for three hours at the rate of twenty-seven miles an hour reached Liverpool. What is the distance between Liverpool and Edinburgh?

(19) If the interest of £276, 3s. 4½d. for one year be £15, what will be the interest for nine years?

(20) If the interest of a sum of money for three years be £27, what will be the interest for thirteen years?

(21) If a box of oranges containing twelve dozen was distributed in a school, and each scholar got half an orange, how many scholars were there?

(22) If the thirty-seventh part of a ship's cargo is valued at £450, what is the value of the whole?

(23) If the rent of five acres for a quarter of a year be £3, what will be the rent for six years?

(24) A man's income is £5 per week, and his expenditure £6. How much will he be in debt at the end of forty-five weeks?

(25) A cistern having two pipes, one running four gallons of water per minute into the cistern, and the other seven gallons out of it, was emptied in a quarter of an hour. How many gallons did it contain at first?

(26) How many shillings are in £36?

(27) How many pence in three hundred and fifty-one shillings?

(28) How many farthings in £9?

(29) How many pence in forty-five pounds?

(30) How many farthings in one hundred and seventeen shillings?

(31) From the Registrar's returns, we find the monthly average of female children born in the eight principal towns in Scotland in 1862, was 1398. How many were born during the year?

(32) The average monthly produce of the New Zealand gold fields for 18 months was 22588 ounces. How much did they produce in that time, and what would be the value of the produce at the rate of £37 per ounce?

(33) A lady distributed £150 among the inmates of Middlesex Hospital at Christmas 1862, giving each half a sovereign. How much would it have taken if the inmates had amounted to nine hundred?

(34) Find the square and cube of twelve.

(35) Find the cube of 369.

(36) Find the sum of the squares of thirty-six and forty-five.

(37) Find the difference of the squares of 612 and 126.

(38) Shew that $375^2 - 374^2 = 375 + 374 : 679^2 - 678^2 = 679 + 678$.

(39) Shew that $24^2 - 22^2 = 2(24 + 22) : 895^2 - 893^2 = 2(895 + 893)$.

(40) Shew that the difference of the squares of 398 and 401 = 3 times their sum.

(41) Shew that the difference of the squares of 5793 and 3847 = 1946 times their sum.

(42) Shew that the difference of the squares of 637 and 379 = product of their sum and difference.

SIMPLE DIVISION.

- (1) A bag containing three hundred and twenty-four nuts was divided among nine boys. How many did each get?
- (2) Divide thirty-two thousand nine hundred and sixty-seven bushels of corn equally among thirty-seven persons.
- (3) Find the 17th part of 5508.
- (4) How many times is 73 contained in 630720?
- (5) In how many hours will a train go one thousand and forty-four miles at twenty-nine miles per hour?
- (6) How many miles an hour does a train go, which goes one thousand six hundred and ninety-two miles in forty-seven hours?
- (7) A plantation contains four hundred and fifty-nine trees in seventeen equal rows. How many trees are there in a row?
- (8) How many dozen apples are in a barrel containing one thousand seven hundred and twenty-eight apples?
- (9) A farrier uses nine nails in putting on one shoe, and in one day he used one thousand nine hundred and forty-four nails. How many horses did he shoe?
- (10) A tradesman made a profit of £4914 in thirteen years. What was his average annual profit?
- (11) The girth of a tree was measured in six places, and the sum of the measurements was one hundred and eight feet. What was the mean girth?
- (12) A gentleman left £5000. By his will he directed that after paying his debts, amounting to £275, the rest should be equally divided among his seven children. How much did each of them receive?
- (13) A wood of six thousand seven hundred and twenty-three trees is to be thinned by cutting down one tree in nine. How many will be left after this clearing?
- (14) The sum of two numbers is eighty-one, and their difference nine. Find the numbers?
- (15) In a school of three hundred and forty-two children there are thirty-six more boys than girls. Find the number of boys and girls respectively.
- (16) At a parliamentary election, out of three thousand and fifteen votes, Mr. Jones had a majority of five hundred and thirty-one over Mr. Smith. How many voted for each?
- (17) Find the average daily drawings in a shop from the following returns. Monday, £23; Tuesday, £17; Wednesday, £34; Thursday, £11; Friday, £18; and Saturday, £59.
- (18) £25 were divided among three persons; £58 among seven; £39 among four; and £22 among two. Suppose the money had been divided equally among them all what would each have received?
- (19) A class-room twenty-seven feet broad contains one thousand two hundred and fifteen square feet. What is its length?
- (20) A court-yard containing fifty-nine thousand six hundred and sixteen square yards is seventy-two yards broad. What is its length?
- (21) How many children can be accommodated in a school fifty-one feet long and twenty-four feet broad, allowing eight square feet to each child?
- (22) How many times will a wheel 15 feet in circumference revolve in going 347490 feet?
- (23) Reduce to pounds 14040 shillings.
- (24) Reduce to shillings 3780 pence.
- (25) Reduce to pence 39492 farthings.
- (26) Reduce to pounds 1764720 pence.
- (27) Reduce to crowns 48060 pence.

(28) In 7416 farthings how many crowns, half-crowns, shillings, and pence, and of each an equal number?

(29) Reduce 128799 yards to poles (Long Measure.)

(30) How long would it take to count £16200 at the rate of one hundred pounds a minute?

(31) A bag containing 160 marbles was to be divided among a class of twenty boys, but it was found that seven of the marbles had been lost and that three of the boys were absent. How many did each get?

MISCELLANEOUS EXERCISES.

(1) A farmer has 2386 sheep, 11 horses, and 321 oxen. What is the number of his live stock?

(2) A boy was sent to the village with eggs in two baskets. The road was slippery, and he fell; on rising he found that in one basket a dozen and in the other 14 were broken. He sold two dozen at the village and carried home 13. How many had he at first?

(3) A grocer receives three boxes of oranges; there were in the first 47 dozen and 9, in the second 36 dozen and 10, in the third 42 dozen and 11. How many oranges were there in all?

(4) What is the difference between 5 dozens and 7 half-dozens?

(5) Mr. Gillies sold to Mr. Sinclair 45 bullocks at £13 each, and Mr. Sinclair sold to Mr. Gillies 279 sheep at £2 each. Which of them must pay money to the other, and how much?

(6) Find the square and cube of 45.

(7) Subtract the square of eighteen from its cube.

(8) Shew that $(37 + 43)^2 = 37^2 + 43^2 + (2 \times 37 \times 43)$.

(9) Shew that $(29 + 58)^2 = 29^2 + 58^2 + (2 \times 29 \times 58)$.

(10) Shew that $(101 + 105)^2 = 101^2 + 105^2 + (2 \times 101 \times 105)$.

(11) From the product of 72 and 44 take the product of 85 and 38.

(12) Find the quotient arising from dividing the product of 7029 and 63 by 99.

(13) Shew that $(9 + 5) \times (9 - 5) = 9^2 - 5^2$.

(14) Shew that $(19 + 7) \times (19 - 7) = 19^2 - 7^2$.

(15) Shew that $(313 + 206) \times (313 - 206) = 313^2 - 206^2$.

(16) Shew that the sum of 19 and 41 multiplied by their difference is equal to the difference of their squares.

(17) How many tons of coals are consumed in a day at the rate of 1343563 tons annually?

(18) 4599 nuts were divided among the boys in a school, each boy got 17 and there were nine over. How many boys were in the school?

(19) A class-room is 36 feet square. What must be the breadth of another 48 feet long to hold the same number of children?

(20) A man had an income of £1200 per annum, and he spent annually £450: at the end of nine years he died, and his money was divided equally among his six children. What did each receive?

COMPOUND ADDITION.

(1) A collector of Poores' Rates went out one day to collect the rates: at the first house he received £1, 3s. 9d.; at the second £2, 0s. 1½d.; at the third £3, 13s. 7½d.; at the fourth £5, 17s. 3½d.; and at the next £5, 8s. 8½d. How much had he by this time in his pocket?

(2) A shopkeeper took on Monday, £3, 17s. 9½d.; on Tuesday, £4, 18s. 6½d.; on Wednesday, £2, 15s. 9½d.; on Thursday, £5, 16s. 10½d.; on Friday, £3, 13s. 7½d., and on Saturday, £6, 2s. 8d. How much did he take that week?

(3) A owes B for tea £2, 5s. 9d. for sugar £8, 16s. 10½d., for cheese £4, 17s. 9½d., for ham £3, 18s. 4½d., for oatmeal £6, 4s. 7d., and for other articles £10, 3s. 9½d. What is the amount of A's debt?

(4) I paid for sheep £17, 5s. 3d., a cow £12, 12s. 6d., a pig £3, 12s. 6d., calves £2, 14s., and tolls 2s. 11d. What sum did I lay out?

(5) A house-keeper paid £12, 14s. 7½d. for flour, £2, 16s. 5½d. for coffee, £7, 5s. 1½d. for tea, £6, 5s. 9d. for cheese, £3, 17s. 1½d. for butter, £12, 9s. 10½d. for sundries. What was her total expenditure?

(6) The rent of a house is £52, 10s., poors'-rates £3, 5s. 7½d., police assessment £2, 19s. 8½d., other taxes £4, 17s. 2d. What is the gross rental?

(7) A man owes his grocer £27, 17s. 10½d., baker £18, 13s. 9½d., butcher £23, 12s. 2½d., hatter £1, 14s. 6d., and bookseller 15s. 11½d. How much does he owe altogether?

(8) The stipend of a parish is paid by four heritors in the following sums—£36, 8s. 9½d., £84, 17s. 9½d., £156, 13s. 6½d., £145, 4s. 5d. What is the minister's stipend?

(9) A merchant bought 4 lots of goods for which he paid £12, 6s. 5d., £73, 2s. 4d., £25, 12s. 9d., and £51, 10s. 10½d. respectively. What did he pay for the whole?

(10) A grain merchant paid for wheat £123, 8s. 6d., for oats £136, 14s. 2d., for barley £35, 12s. 7d., for beans £28, 9s. 5½d. How much did it take to pay the whole?

(11) Bought articles for £67, 9s. 6½d., and then I bought other three lots for which I paid £44, 5s. 9d., £25, 9s. 7d., and £25, 7s. 6d. respectively. How much did I pay for the whole?

(12) A draper paid £143, 4s. 8d. for cloth, £94, 8s. 9d. for silks, £63, 4s. 8d. for ribbons, and £23, 6s. 7d. for linen. How much did he pay in all?

(13) A merchant's clerk being sent to collect payment of accounts; at Aberdeen he received £1879, 9s. 5d., at Inverness he received £675, 13s. 10½d., at Perth he received £101, 18s. 4d., and at Stirling he received £88, 7s. 4½d., he then deposited all he had in the bank. How much did he deposit?

(14) What are the assets and liabilities of Mr. Smith? Of the former the items are £435, 18s. 4½d., £331, 16s. 7½d., £222, 17s. 2½d., £242, 14s. 3½d., and of the latter the items are £748, 16s. 11½d., £341, 16s. 8½d., £232, 10s. 8½d.

(15) Shew that the following account is balanced; the items on the Dr. side are £978, 13s. 1½d., £964, 14s. 2½d., £741, 13s. 7½d., £424, 16s. 2½d., and £121, 9s. 0½d., and the items on the Cr. side are £2101, 5s. 0½d., £421, 5s. 4½d., £382, 9s. 3½d., £113, 6s. 6½d., and £212, 19s. 11½d.

(16) What was the expense of a wall the materials of which cost £150, 7s. 10½d., masons' wages £95, 14s. 9d., and labourers' wages £78, 2s. 1d.?

(17) I bought a piano for fifty guineas, a harmonium for ten guineas, and paid for carriage twelve shillings and sixpence. What was the total expense?

(18) A man bought a horse, a gig, and a set of harness, which cost respectively, twenty guineas, nineteen guineas, and eighteen crowns. What did he pay in all?

(19) A sideboard and a dining-table cost each £27, 5s. 4d., including their carriage to the country; a mirror cost as much as both, and an easy chair £8, 2s. What did they cost in all?

(20) A book-case cost £7, 11s. 5½d., including repairs, the books on the top shelf are valued at £42, 7s. 9d., on the second shelf at £63, 5s. 8d., on the third shelf at as much as the two above it, and on the fourth shelf at as much as the second and third. What is the value of the whole?

(21) A man owes his bookseller £2, 17s. 9d., his draper as much again, his butcher as much as these two together, his grocer as much as his bookseller and butcher, and his baker £1, 14s. 2d. more than his draper. What does he owe in all?

(22) Shew that the following balance sheet of a bank is correct. *Liabilities.*—Paid-up capital, £500000; deposits, £700372, 0s. 7d.; bills payable, £1289084 4s. 8d.; circulation, £72915; reserved fund, £11232, 13s. 5d.; amount carried to profit and loss account, £34771, 15s. 11d. *Assets.*—bills receivable &c., £1160773, 6s. 6d.; specie and bullion, £383120, 16s. 8d.; bank premises and furniture, £61401, 5s. 4d.; preliminary expenses, £3080, 6s. 1d.

COMPOUND SUBTRACTION.

- (1) From £101, 3s. 1d. take £1, 3s. 5d.
- (2) Subtract ninepence from £72, 15s. 1d.
- (3) From one hundred pounds take fourpence.
- (4) Required the difference between £2394, 13s. 5½d. and £1997, 14s. 2¾d.
- (5) A man borrowed £124, 5s. 11d., and paid back £24, 6s. 3d. What does he still owe?
- (6) £91227, 14s. 7d. were collected for a charity, but the expenses of collection amounted to £1200, 9s. 3d. What was the sum actually realized for the charity?
- (7) A bankrupt owes £148, 1s. 6d., and his effects amount to £39, 19s. 11¾d. Find the deficit.
- (8) I sold goods for £200, on which I had a profit of £28, 5s. 9¾d. What was the prime cost?
- (9) I bought goods for £4597, 18s. 4¼d., and sold them for £4994, 17s. 7¼d. What did I gain?
- (10) What sum added to £18, 3s. 10d. will be equal to one thousand pounds?
- (11) On an account of £48, 2s. 6d. there was allowed for discount £2, 13s. 6d. What was the net sum paid?
- (12) The gross rental of a property is £775, 18s. 3d.; the factor's commission is £37, 10s. 9d. What does the landlord receive?
- (13) A debtor owing £80, 8s., paid £36 14s. 8d., and afterwards £25, 9s. 10d. What does he still owe?
- (14) A person having £202, 7s. 10d. in the bank; drew out £106, 14s. 7d. and shortly afterwards £68, 7s. 11d. What has he still in the bank?
- (15) Mr. Smith owes Mr. Brown £39, 10s. 7d. for potatoes, and £23, 13s. 4d. for turnips; and Mr. Brown owes Mr. Smith £25, 17s. 6d. for cattle, and £82, 15s. 5d. for sheep. In whose favour is the balance, and to what amount?
- (16) Shew that £47, 16s. 0¼d. + £89, 13s. 3¾d. — (£89, 13s. 3¾d. — £47, 16s. 0¼d.) = £95, 12s. 0½ — £47, 16s. 0¼d. + £109, 15s. 3¾d. — £61, 19s. 3¼d.
- (17) Shew that £7397, 17s. 11¾d. + £1089, 19s. 0¼d. + (£7397, 17s. 11¾d. — £1089, 19s. 0¼d.) = £14795, 15s. 11¼d. — £7397, 17s. 11¾d. + £7397, 17s. 11¾d.
- (18) Shew that £3251, 3s. 7¼d. + £90967, 5s. 4¼d. — (£90967, 5s. 4¼d. — £3251, 3s. 7¼d.) = £3251, 3s. 7¼d. + £3251, 3s. 7¼d.
- (19) From the preceding exercise state the rule for finding the *less* of two numerical quantities whose sum and difference are given.
- (20) A grain merchant went to market and bought wheat and barley, for which he gave the sum of £963, 12s. 6d. The wheat cost him £62, 12s. 6d. more than the barley. What did he pay for each?

(21) Balance the following accounts as at March 31st.

(a) Feb. 5.	To goods,	£17 15 6	Mar. 4.	By cash,	£31 5 3
" 17.	" do.	6 4 0	" 4.	" discount,	1 12 11
Mar. 1.	" do.	8 18 8	" 31.	" balance,	
" 30.	" do.	6 18 4			
<hr/>					
(b) Jan. 3.	To cash,	£109 17 4	Jan. 9.	By goods,	£118 15 6
" 3.	" discount,	8 18 2	" 23.	" do.	59 5 6
Mar. 31.	" balance,		Feb. 26.	" do.	101 14 10

COMPOUND MULTIPLICATION.

- (1) The price of one sheep is £1, 14s. 1d. What is the price of sixteen?
- (2) What is the price of eight articles at £4, 10s. 10½d. each?
- (3) What is the price of thirty-two yards of cloth at 17s. 0½d. a yard.
- (4) What is the price of two hundred and eighty-eight articles at the rate of 8½d. each?
- (5) A farmer pays £27, 0s. 4½d. for wages in a week. How much will he pay in thirty-two weeks?
- (6) What is the price of two hundred and twenty four horses at an average of £15, 18s. 3½d. each?
- (7) What is the price of five hundred and twelve articles at an average of 2s. 1½d. each?
- (8) What will be the composition on £14400, at the rate of 8s. 9d. per pound?
- (9) What is the price of thirty-six score of sheep at the rate of £2, 17s. 6d. each, including 14s. for tolls?
- (10) A road thirty-three yards long was made at an expense of £3, 16s. 6½d. per yard. What was the cost of the whole?
- (11) If £18, 13s. 8½d. keep a house for one month, how much will it take to keep it for fourteen months at the same rate?
- (12) What is the price of eighteen dozen of wine at an average price of £2, 0s. 4½d. per dozen?
- (13) A farmer employs twenty-seven labourers at twelve shillings and sixpence per week, and as many at seven and sixpence per week. He pays for boys' wages 5s. 4d. What wages does he pay for labour per week?
- (14) What is the price of 288 yards at 17s. 7½d. per yard, deducting £1, 11s. 7½d. for discount?
- (15) A gentleman spends at the rate of 7s. 4½d. per day, and at the end of the year he has £90, 13s. 1½d. What is his yearly income?
- (16) An officer with a pay of one and a half guineas per day, finds at the year's end that his expenses have exceeded his income by £1, 17s. 8d. What were his expenses for the year?
- (17) Four horses are kept from 6th February till 3rd September, at the rate of 2s. 8d. each per day. Repairs of harness and other charges amount to £5, 14s. 0½d. What is the total expense?
- (18) What is the price of two tons of cheese at the rate of 5½d. per pound, allowing for carriage £1, 19s. 8d.?
- (19) A grocer buys a ton of sugar at the rate of 4½d. per lb. and gains £3, 9s. by selling it. What is the selling price per ton?

COMPOUND DIVISION.

- (1) If seven horses cost £69, 6s. What will one cost?
- (2) What is the eighth part of £145, 8s.?

- (3) Divide £299, 18s. 8d. equally among eleven persons.
- (4) What is the price of one acre if seventeen acres cost £927, 1s. 4d.?
- (5) The salaries of twenty-five persons amount to £2272, 10s. What is the average salary of each?
- (6) A grocer takes at the counter £1417, 17s. 4d. in the course of a year. What is his weekly average?
- (7) A public work pays £101486, 0s. 2½d. for wages in a year. What is the average of each working day?
- (8) Divide £3517, 15s. 2d. of prize-money among a captain, three officers, and thirty-one sailors; giving to each officer twice as much as to a sailor, and to the captain three times as much as to an officer. What is each sailor's share?
- (9) Sixty-seven persons engage in a speculation which yields altogether £9068, 10s. 4½d. What is each person's share of the profit supposing it divided equally?
- (10) The yearly expenses of the inhabitants of a town amount to £253282, 12s. 6d. What is the daily average?
- (11) Find the one thousandth part of £792916, 13s. 4d.
- (12) A Society consisting of two hundred members, through the misconduct of the manager incurs liabilities to the amount of £50490, 16s. 2½d.: seven of the members refusing to pay their share. What must each of the other members pay?
- (13) A mixture is made of seven chests of tea at £20 per chest, nine chests at £15, three chests at £16, 17s. 6d., and four chests at £23, 2s. What is the price of a chest of it?
- (14) Mr. Brown has two shares in a gas work, the capital of which is made up of one hundred and six equal shares, there is a clear profit of £524, 14s. at the end of the year. How much should Mr. B. receive?
- (15) A horse dealer bought twenty-nine horses at twenty guineas each and sold them at next market, losing by the transaction £81, 18s. 6d. At what rate did he sell them on an average?

$$\begin{array}{l}
 (16) \text{ Shew that—} (a) \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 34 \quad 13 \quad 8\frac{1}{2} \times 81 \\ \hline 97 \end{array} + \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 62 \quad 6 \quad 3\frac{3}{4} \times 81 \\ \hline 97 \end{array} = \text{£}81 \\
 (b) \quad \begin{array}{r} 397 \quad 16 \quad 5\frac{1}{2} \times 49 \\ \hline 469 \end{array} + \begin{array}{r} 71 \quad 3 \quad 6\frac{1}{2} \times 49 \\ \hline 469 \end{array} = \text{£}49 \\
 (c) \quad \begin{array}{r} 271 \quad 10 \quad 7\frac{1}{2} \times 69 \\ \hline 529 \end{array} + \begin{array}{r} 257 \quad 0 \quad 4\frac{1}{2} \times 69 \\ \hline 529 \end{array} = \text{£}69 \\
 (d) \quad \begin{array}{r} 631 \quad 19 \quad 11\frac{1}{2} \times 78 \\ \hline 707 \end{array} + \begin{array}{r} 75 \quad 0 \quad 0\frac{1}{2} \times 78 \\ \hline 707 \end{array} = \text{£}78
 \end{array}$$

MISCELLANEOUS.

- (1) John Smith and William Thomson went to Australia. J. S. sent home £126, 0s. 2d., and W. T. three times as much. How much did they both send home?
- (2) How many penny rolls can be bought for two shillings and three pence?
- (3) How many farthings altogether in two shillings and seven pence, and in one half-penny?

- (4) How many in 2s. $7\frac{1}{2}d.$, 4s. $10\frac{1}{2}d.$, 16s. $3\frac{1}{2}d.$?
- (5) John Smith bought half a pound of sugar at $5d.$, two oz. of tea at $3\frac{1}{2}d.$, a loaf at $6d.$, and a box of matches for a farthing. What change did he get out of one shilling and sixpence?
- (6) A grocer bought 137 lbs. of tea at 3s. $5d.$ per pound, and sold it so as to gain £3, 17s. $3d.$ What did it bring?
- (7) A draper bought $59\frac{1}{2}$ yards of cloth at 3s. $7d.$ per yard, and had a profit of £7, 9s. $4\frac{1}{2}d.$ How much did he receive for the whole piece?
- (8) I went to a shop and bought 7 yards of cloth at 10s. and 2 yds. at 6s. What change did I get out of £5?
- (9) Out of a florin a boy bought a whistle for $3d.$, a pop-gun for $4\frac{1}{2}d.$, and lost out of his pocket as much as he spent. What had he left?
- (10) Find the fifty-seventh part of £1554, 4s.
- (11) A boy was sent messages to two shops with two half-crowns. In the first shop he gave one of them at the counter and got back in change $7\frac{1}{2}d.$; in the second he had to pay 2s. $11\frac{1}{2}d.$ How much did he bring back?
- (12) A man sold 54 yds. at 12s. $9\frac{1}{2}d.$ and as many more at 7s. $2\frac{1}{2}d.$ What money did he get in all?
- (13) In a town there are three streets: each street has 235 houses, and each house has on an average nine inmates. What is the population?
- (14) If apples are sold at $2d.$ per pound, how many pounds will three shillings purchase?
- (15) If eggs are sold at five for $2d.$, what will three dozen and nine cost?
- (16) I bought 3 yds. of cloth at 5s. $2d.$; 4 yds. at 4s. $6d.$, and 2 yds. at 3s. $6d.$; what was the average price per yard?
- (17) When eggs are selling at 5 for $2d.$, what should a basket holding eleven dozen and three cost?
- (18) The sixteenth part of £36362, 14s. is to be divided equally among nine persons, what is the share of each?
- (19) A cattle dealer bought 45 sheep for £75, 10s., and sold 18 at 29s. $6d.$ each. At what price did he sell the rest when he lost £12, 10s. by the transaction?
- (20) What is the worth of two-thirds of £40, 18s.?
- (21) What is the value of four-fifths of £45, 8s. $11\frac{1}{2}d.$?
- (22) I bought two pieces of cloth measuring respectively 59 and 41 yards at 12s. $6d.$ per yd., and in retailing them I gained £10, 4s. $4d.$ What did they bring?
- (23) I bought 67 yds. of cloth at 15s. $9\frac{1}{2}d.$ per yd., and as many at 4s. $2\frac{1}{2}d.$ per yd., and in retailing them I lost £3, 7s. $6d.$ What did I sell them for?
- (24) The sixth part of £1247, 8s. is to be divided equally among 21 persons. What is the share of each?
- (25) A gentleman left home for a pleasure tour with 21 guineas in his pocket, 4 of which he paid for a return ticket, and his other expenses were on an average 19s. $10\frac{1}{2}d.$ a day. How much did he bring home after enjoying himself for eight days?
- (26) I bought 27 gals. of spirits at 13s. $6d.$ per gal. How much water must be added to allow of the price being reduced to 10s. $1\frac{1}{2}d.$ per gal.?

CALCULATIONS.

BY MULTIPLICATION.

Example—If 3 yards cost £1, 2s., what will 27 yards cost?

cost of 3 yards = £1, 2s.

cost of 27 yards = 9 times £1, 2s. = £9, 18s.

- (1) If 5 yards cost £2, 9s. 6d., what will 20 yards cost?
- (2) If 3 yards cost £2, 5s. 5½d., what will 24 yards cost?
- (3) How much must be paid for 32 yards if 4 yards cost 6d., 16s. 4d.?
- (4) The wages of 8 men amount to £7, 6s. 5½d., what will the wages of 128 men amount to?
- (5) If a man walk 81 miles in 3 days, how far will he walk in 15 days?
- (6) The rent of 26 acres is £31, 16s. 3d., what is the rent of 52 acres?
- (7) How many yards may be bought for £54 at the rate of £9 for 6 yards?
- (8) How many yards will a mason build in 3 weeks, who builds 18 yards in 3 days?

BY DIVISION

Example—If 6 yards cost 6s. 9d. what will 2 yards cost?

cost of 6 yds. = 6s. 9d.

cost of 2 yds. = $\frac{1}{3}$ of 6s. 9d. = 2s. 3d.

- (1) If 9 lbs. of butter cost 13s. 6d., what will 3 lbs. cost?
- (2) If 21 yards cost £1, 16s. 9d., what will 3 yards cost?
- (3) If 56 sheep cost £79, 4s., what will 7 cost?
- (4) If the income tax on £144 is £10, 16s., what will it be on £12?
- (5) How long would 36 labourers take to dig a field which 12 men can dig in 27 days?
- (6) How many men would finish a job in 54 days which 27 men can do in 18 days?
- (7) What is the price of a bottle of wine at the rate of £2, 5s. per dozen?
- (8) A score of sheep cost £49, 10s. What is the price of four sheep?

BY DIVISION & MULTIPLICATION.

Example—If 8 yards cost 10s., what is the cost of 3 yards?

cost of 8 yds. = 10s.

cost of 1 yd. = $\frac{1}{8}$ of 10s. = 1s. 3d.

cost of 3 yds. = 3 times 1s. 3d. = 3s. 9d.

- (1) If 7 articles cost 15s. 9d., what is the cost of 4?
- (2) If 12 articles cost £13, 4s., what is the cost of 9?
- (3) If 11 articles cost £37, 9s. 10d., what is the cost of 8?
- (4) If a man walk 21 miles in 7 hours, how far will he walk in 9 hours?
- (5) If 35 sheep cost £127, 4s. 6d., what is the cost of 5?
- (6) The rent of 5 acres is £26, 10s. 2½d. What is the rent of 12?
- (7) If 7 horses are bought for £63, how many can be bought for £81?
- (8) I bought 40 volumes for £4, 10s. What was the cost of 12?

The following exercises are to be worked by either of the following methods.

Example—If 24 yds. cost £13, 4s., what will be the price of 18 yds.?

METHOD FIRST.

If 24 yds. cost £13, 4s.

6 yds. will cost $\frac{1}{4}$ or £3, 6s.

18 yds. will cost $\frac{3}{4}$ or £9, 18s.

METHOD SECOND.

If 24 yards cost £13, 4s.

1 yd. will cost $\frac{1}{24}$ of £13, 4s., and

18 yds. will cost $\frac{3}{4}$ of £13, 4s., or $\frac{3}{4}$ of £13, 4s., or £9, 18s.

Note to method second—That $\frac{3}{4}$ = $\frac{3}{4}$ will be evident without any knowledge of fractions. Take another example, $\frac{3}{4}$ = $\frac{3}{4}$ = $\frac{1}{2}$: for it is the same thing if we divide the unit into 12 equal parts and take 6 of them, (see A) or into 6 equal parts and take 3 of them, (see B,) or into 2 equal parts and take one of them, (see C.) Take the unit (1s.) twelve pence.

A, twelve equal parts,	0 0 0 0 0 0, 0 0 0 0 0 0	six taken.
B, six equal parts,	00 00 00, 00 00 00	three taken.
C, two equal parts,	000000, 000000	one taken.

Thus a fraction may be simplified by dividing both numerator (upper figure) and denominator (lower figure) by any number that will divide them both without a remainder. For practice, simplify $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}, \frac{1}{11}, \frac{1}{12}, \frac{1}{13}, \frac{1}{14}, \frac{1}{15}, \frac{1}{16}, \frac{1}{17}, \frac{1}{18}, \frac{1}{19}, \frac{1}{20}, \frac{1}{21}, \frac{1}{22}, \frac{1}{23}, \frac{1}{24}, \frac{1}{25}, \frac{1}{26}, \frac{1}{27}, \frac{1}{28}, \frac{1}{29}, \frac{1}{30}, \frac{1}{31}, \frac{1}{32}, \frac{1}{33}, \frac{1}{34}, \frac{1}{35}, \frac{1}{36}, \frac{1}{37}, \frac{1}{38}, \frac{1}{39}, \frac{1}{40}, \frac{1}{41}, \frac{1}{42}, \frac{1}{43}, \frac{1}{44}, \frac{1}{45}, \frac{1}{46}, \frac{1}{47}, \frac{1}{48}, \frac{1}{49}, \frac{1}{50}, \frac{1}{51}, \frac{1}{52}, \frac{1}{53}, \frac{1}{54}, \frac{1}{55}, \frac{1}{56}, \frac{1}{57}, \frac{1}{58}, \frac{1}{59}, \frac{1}{60}, \frac{1}{61}, \frac{1}{62}, \frac{1}{63}, \frac{1}{64}, \frac{1}{65}, \frac{1}{66}, \frac{1}{67}, \frac{1}{68}, \frac{1}{69}, \frac{1}{70}, \frac{1}{71}, \frac{1}{72}, \frac{1}{73}, \frac{1}{74}, \frac{1}{75}, \frac{1}{76}, \frac{1}{77}, \frac{1}{78}, \frac{1}{79}, \frac{1}{80}, \frac{1}{81}, \frac{1}{82}, \frac{1}{83}, \frac{1}{84}, \frac{1}{85}, \frac{1}{86}, \frac{1}{87}, \frac{1}{88}, \frac{1}{89}, \frac{1}{90}, \frac{1}{91}, \frac{1}{92}, \frac{1}{93}, \frac{1}{94}, \frac{1}{95}, \frac{1}{96}, \frac{1}{97}, \frac{1}{98}, \frac{1}{99}, \frac{1}{100}$.

- (1) If 16 yards cost 2s. 6d., what is the price of 24?
- (2) If 63 pigs cost £218, 3s., what will 21 cost?
- (3) If 27 yards cost £54, 10s. 9d., what will 18 yards cost at the same rate?
- (4) If 99 articles cost £81, 15s. 9d., what will 22 cost at that rate?
- (5) If 49 tons cost £190, 17s. 4d., what will be the price of 14 tons?
- (6) If 35 sheep cost £68, 3s. 4d., what will 28 cost?
- (7) If 15 oz. cost 2s. 1d., what is the price of 27 oz?
- (8) If 70 volumes cost £39, 15s. 3d., what will 112 cost?
- (9) What will be the price of two dozen bottles of wine, if 16 cost £6, 12s.?
- (10) A man after working 52 days finds he has earned £20, 4s., what should he earn in 117 days?
- (11) If £27, 5s. 4d. provide coals for 42 poor persons, how much would it take to supply 112 more at the same rate?
- (12) What will 34 sheep cost at the rate of £368, 2s. 9d. for 153 sheep?

PER CENTAGES.

Cent (from *centum*, a hundred) means a hundred. Five per cent means 5 units in every hundred. This may be written $\frac{5}{100}$ or $\frac{1}{20}$. (see previous section.) Of a school of 140 pupils, if 5 per cent were absent, that would be $\frac{1}{20}$ of the number, or 7. So 10 per cent $\frac{10}{100} = \frac{1}{10}$. Hence 10 per cent on £363, 11s. 8d. is $\frac{1}{10}$ of £363, 11s. 8d. or £36, 7s. 2d. 5 per cent = $\frac{5}{100}$. If the units are pounds.

5 per cent = $\frac{5}{100}$ = $\frac{1}{20}$ 1s. per £	2½ per cent = 6d. per £
10 per cent = $\frac{10}{100}$ = $\frac{1}{10}$ 2s. per £	1½ per cent = 3d. per £
15 per cent = $\frac{15}{100}$ = $\frac{3}{20}$ 3s. per £	3½ per cent = 9d. per £

Interest is a per centage paid for the use of money.

Insurance is a per centage paid for insuring property or life.

Commission is a per centage paid to an agent for buying or selling goods for another person.

Brokerage is a smaller per centage of the same kind, and is generally paid for completing money transactions.

Bankers' Discount is a per centage charged for paying money before it is due. Generally 5 per cent.

Tradesmen's Discount is a per centage deducted from accounts when paid in ready money. Generally 5 per cent.

- (1) Of 180 quarters of wheat brought to market, 35 per cent remained unsold; how many were sold?
- (2) Of a school of 288 children, 25 per cent were under seven years of age; how many were above that age?
- (3) How much lead is contained in 648 pounds of ore, if the ore contains 75 per cent of the metal?
- (4) Of 975 prisoners 4 per cent could not read: how many could?
- (5) Of 1872 voters in a town, 12½ per cent voted for the liberal, and the rest for the conservative candidate: how many voted for each, and what was the majority?

- (6) Find 10 per cent on £630; on £1170; on £454, 10s.; and on £727, 3s. 4d.
- (7) Find 5 per cent on £198; on £909; on £1454, 6s. 8d.; and on £1636, 3s. 4d.
- (8) Find 4 per cent on £454, 7s. 6d.; on £2272, 10s.; on £908, 19s. 2d.; and on £2499, 11s. 8d.
- (9) Find the interest on £757, 10s. for one year at 6 per cent.
- (10) Find the commission on £2701, 18s. 0½d. at 4 per cent.
- (11) Find the brokerage on £21615, 4s. 2d. at ½ per cent.
- (12) Find the expense of insuring £1817, 18s. 4d. at 4 per cent.
- (13) What is the premium on a life-policy of £1696, 13s. 4d. at 3½ per cent?
- (14) What discount would a tradesman allow on an account of £4, 10s., and on another of £6, 15s.?
- (15) Find tradesmen's discounts on accounts of the following amounts: £545, 6s. 8d., £727, 3s. 4d., £1090, 13s. 4d.
- (16) Find the commission for the purchase of goods to the value of £18747, at 2½ per cent.
- (17) Find the commission on the following sums at 12½ per cent:—£1874, 13s. 8d., £2739, 7s. 2d., £3458, 10s. 8d., £3385, 16s., £4105, £4468, 12s., £3749, 8s., £581, 14s. 8d., £509, £1010, 1s. 6d., £1591, 16s. 2d., £4896, 18s. 8d., £4824, 4s., £4969, 13s. 4d., £5187, 16s.
- (18) Find the commission on the following sums at 6½ per cent:—£1018, £8210, £1163, 9s. 4d., £2020, 3s., £3183, 12s. 4d., £3749, 7s. 4d., £6771, 12s., £6917, 1s. 4d., £5478, 14s. 4d., £7498, 16s., £8937, 4s., £9032, 13s. 4d., £9793, 17s. 4d., £9039, 6s. 8d., £10375, 12s.

BILLS OF PARCELS, &c.

Make out the following Bills of Parcels after the following example.

Mr. Smith, 37 High Street, Perth.

Bought of Alexander Jones, 35 Albert Street, Edinburgh.

1863.

March 6.	29 yards muslin,	@ 1/9½	£2 11 11½
	42½ " flannel,	@ 1/8	3 11 3
	38½ " linen,	@ 2/3	4 6 7½
	57½ " silk, No. 1,	@ 2/8	7 13 8
			£18 3 6

(1) 1857, January 23. Mr. Alexander Brown, Dalkeith, bought of Charles Downie, King Street, Edinburgh, 100 yds. Welsh flannel, No. 2, at 1s. 10d.; 88 yds. cambric, No. 1, at 3s. 10d.; 60 yds. cambric, No. 2, at 5s. 10d.; 100 yds. cotton, No. 1, at 1s. 5d.; 50 yds. ¾ gingham blue, at 1s. 6d.; wrapper, 3s. 4d.

(2) 1858, February 24. Mr. Edward Finlay, Falkirk, bought of George Henderson, High Street, Glasgow, 42 yds. ¾ muslin at 2s. 10d., 158½ yds. ¾ muslin at 1s. 8d., 60 yds. cambric, No. 1, at 3s. 10d.; 50 yds. cambric, No. 2, at 5s. 10d.; packing and wrapper, 3s. 9d.

(3) 1859, March 25. Mr. Isaac Johnstone, Kilmarnock, bought of Lewis Morrison, Princess Street, Glasgow, 22 lbs. raisins at 8½d., 56 lbs. sugar at 6d., 25 lbs. tea at 4s. 4d., 28 lbs. coffee at 1s. 6d., 14 lbs. rice at 3½d.

(4) 1860, April 26. Mr. Neil Oliver, Lanark, bought of Peter Robertson, Glassford Street, Glasgow, 15 yds. cassimere, black, at 8s. 4d.; 20 yds. cassimere, drab, at 7s. 2d.; 60 yds. Welsh flannel, No. 2, at 1s. 10d.; 57 yds. Welsh flannel, No. 1, at 2s. 10d.; packing and wrapper, 5s. 6d.

(5) 1862, Sept. 21. Mr. Matthew Montgomery, Irvine, bought of Oliver Munro, Renfield Street, Glasgow, 14 lbs. mutton at $7\frac{1}{2}d.$, 8 lbs. steak at $10d.$, 15 lbs. veal at $8d.$, 6 lbs. lamb at $9d.$, 6 lbs. suet at $6d.$; carriage $4d.$

Make the extensions in each line, and make a proper account for the following:—

(6) 1862, Oct. 13. Mr. James M'Lachlan, Corstorphine, bought of Peter Robertson, Queen Street, Edinburgh, 28 lbs. sugar at $5\frac{1}{2}d.$, 7 lbs. tea at $3s. 8d.$, 32 lbs. cheese at $8\frac{1}{2}d.$, 24 lbs. butter at $1s. 1d.$, 10 st. oatmeal at $2s. 10d.$, 6 st. flour at $2s. 11d.$, 10 lbs. ham at $9\frac{1}{2}d.$, 32 lbs. bacon at $9d.$, matches $3d.$, 28 lbs. soap at $5\frac{1}{2}d.$, 12 lbs. coffee at $1s. 8d.$

(7) 1863, Jany. 14. Mr. William Sutherland, Portobello, bought of David Hutcheson, George Street, Edinburgh, 300 envelopes at $8d.$ per 100, 2 gross pen-holders at $3\frac{1}{2}d.$ per doz., 1 doz. Testaments at $5\frac{1}{2}d.$, 12 quires foolscap at $8\frac{1}{2}d.$, 3 doz. copy-books at $3\frac{1}{2}d.$, 2 Bibles at $1s. 3d.$, 2 doz. prayer-books at $3d.$, 3 magazines at $1s.$

WEIGHTS AND MEASURES.

ADDITION.

(1) A grocer bought 3 casks of sugar containing respectively 13 cwt. 2 qrs. 17 lbs., 12 cwt. 1 qr. 23 lbs., 10 cwt. 0 qrs. 24 lbs. How much did he buy altogether?

(2) A provision merchant sells on an average 24 st. 3 lbs. of potatoes in a day: what is his average sale in pounds per week?

(3) A farm consists of 70 ac. 2 ro. 9 po. under crop, 46 ac. 2 ro. 17 po. pasture, 13 ac. 2 ro. 22 po. woodland, 4 ac. 3 ro. 7 po. orchard. What is the extent of the farm?

(4) A farmer has two fields containing respectively 26 ac. 2 ro. 17 po., and 18 ac. 1 ro. 39 po., but by removing the hedge between them he gains 29 poles. What is now the extent of the field?

(5) Six persons bought 12 ac. 0 ro. 12 po. each, find (compound addition) the total extent of the land.

(6) A person bought 5 yds. 3 qrs. 1 nl., 2 yds. 2 qrs. and 1 yd. 1 qr. for a suit of clothes. How much did he buy altogether?

(7) If a man walks 9 miles and 9 poles in one day. Find (comp. addition) the distance he will have travelled in five days at the same rate.

(8) Find the total length of iron rails on a double lined railway, when the length of the line is 27 miles 27 poles.

(9) A person bought 10 qrs. 7 bu. 3 pks. of wheat, 8 qrs. 5 bu. 2 pks. of barley, and 8 qrs. 1 bu. 2 pks. of beans. How much did he buy in all?

(10) A spirit merchant sold 7 gals. 2 qts. 1 pt. on Monday, 5 gals. 1 qt. 1 pt. on Tuesday, 9 gals. 3 qts. on Wednesday, 8 gals. 2 qts. 1 pt. on Thursday, 9 gals. 3 qts. 1 pt. on Friday, and 12 gals. 3 qts. on Saturday. How much did he sell that week and what was his average sale per day?

(11) A draper sold 14 yds. 2 qrs. 1 nl. of cloth on Monday, 16 yds. 1 qr. 2 nls. on Tuesday, 17 yds. 2 qrs. 2 nl. on Wednesday, 13 yds. 1 qr. 2 nls. on Thursday, 18 yds. 2 qrs. 1 nl. on Friday, and 27 yds. 2 nls. on Saturday. How much did he sell that week, and what was his average sale per day?

SUBTRACTION.

(1) A coal merchant had 81 tons 17 cwt. 3 qrs. of coals, but sold 54 tons 11 cwt. What had he left?

(2) A grocer bought 97 cwt. 2 qrs. 22 lbs. of sugar, and sold 15 cwt. 3 qrs. 25 lbs. what had he left?

(3) A provision merchant bought 15 tons 3 cwt. 2 qrs. of potatoes, and sold first 3 tons 3 cwt. 2 qrs. and then 2 tons 17 cwt. 3 qrs. How much had he left?

(4) A potato merchant bought 81 tons 17 cwt. 3 qrs. and sold 54 tons 11 cwt. How much had he left?

(5) A farmer had 15 tons 3 cwt. 2 qrs. of turnips and sold first 3 tons 9 cwt. 3 qrs., then 2 tons 11 cwt. 2 qrs. How much had he left?

(6) Two luggage trains carried respectively 173 tons 3 cwt. 1 qr. and 154 tons 18 cwt. 3 qrs. What was the difference?

(7) A farmer has 90 ac. 1 ro. 31 po. under cultivation, and 17 ac. 3 ro. 39 po. in pasture. How much more has he under cultivation than in pasture?

(8) What is the difference between two farms containing respectively 240 ac. 3 ro. 31 po. and 186 ac. 2 ro. 17 po.?

(9) Two fields contain respectively 200 ac. and 82 ac. 1 ro. 3 po. What is the difference in size?

(10) I bought 41 qrs. 1 bu. of wheat and sold 13 qrs. 2 bu. 1 pk. What had I left?

(11) A tailor bought two pieces of cloth measuring respectively 29 yds. and 19 yds. 1 qr. 3 nls. What was their difference in length?

(12) A draper bought two pieces of cloth measuring respectively 27 yds. 1 qr. 1 nl. and 26 yds. 3 qrs.: of the former he sold 17 yds. 3 qrs., and of the latter, 17 yds. 3 nls.; how much remains of each piece?

(13) From the sum of 45 miles 45 yds. and 72 miles 72 yds. take their difference.

(14) Find the sum of 45 lbs. 2 oz. 13 drs. and 90 lbs. 5 oz. 10 drs. and from it subtract their difference.

(15) Find the sum and difference of 18 ho. 0 min. 18 sec., and 81 ho. 1 min. 21 sec.

MULTIPLICATION.

(1) A field contains 9 ac. 0 ro. 9 po. What is the size of six such?

(2) What would be the weight of five carts of coals each weighing 18 cwts. 0 qrs. 18 lbs.?

(3) How many acres will graze twenty-seven oxen, allowing 2 ac. 2 po. for each?

(4) A gold ornament weighs 9 oz. 9 gra. Required the weight of a dozen such?

(5) The Roman pace was 2 ft. 6 in. How many yards would a regiment of soldiers travel in three quarters of an hour at the rate of one hundred and eight paces a minute?

(6) A watch loses 4 min. 12 sec. in a day. How many minutes will it have lost in fifteen days?

Find the net weight

(7) Of 18 casks of butter each weighing 4 cwt. 0 qrs. 18 lbs.; tare 14 lbs. per cask.

(8) Of 6 hhds. of sugar, each weighing 12 cwt. 2 qrs. 16 lbs.; tare, 2 qrs. 4 lbs. per hhd.

(9) Of 18 barrels of rice, each weighing 3 cwt. 1 qr. 15 lbs.; tare 1 qr. 12 lbs. per barrel.

(10) Of 24 hhds. of tobacco, each weighing 3 cwt. 0 qrs. 27 lbs.; tare 24 lbs. per hhd.

(11) Of 9 bags of pepper, each weighing 59 lbs. 2 oz.; tare, 5 lbs. 2 oz. per bag.

(12) Of 13 barrels of soap, each weighing 4 cwt. 0 qrs. 24 lbs.; tare, 34 lbs. per barrel.

(13) If it takes four yards and a half of cloth for one suit of clothes, how many will it take for ten?

(14) If a person travel every week day at the rate of 9 miles 9 po. a day, how far will he have travelled in fifteen consecutive days?

(15) A farmer reaps from one field 3 qrs. 3 pks. of grain, how much will he obtain from nine such?

(16) If one bag of potatoes weigh 3 st. 12 lbs., what will be the weight of twenty-eight such?

(17) If 3 yds. 1 qr. 2 nls. make one coat, how much will be required for twenty-four of the same size?

(18) If 3 ac. 3 po. of land serve for pasturing 5 sheep, how much would be required for 135?

(19) If 5 casks of spirits contain 82 gal. 1 pt., how many will 40 casks contain?

(20) If 8 pieces of cloth contain 222 yds. 3 nls., how many will 128 of the same length contain?

(21) A farmer reaps from 5 fields, 269 qrs. 2 bu., how much will he obtain from 60 at the same rate?

(22) Reduce to drs. 5 lbs. 4 oz. 15 drs.

(23) How many pounds in nine tons?

(24) How many seconds in a day?

(25) How many inches in a furlong?

(26) In a square pole how many square inches?

(27) How much will a mill grind in a year at the rate of 10 qrs. 2 bu. 2 pks. a day, deducting (besides Sundays) twenty-five holidays?

COMPOUND DIVISION.

(1) Seven pieces of cloth contained 66 yds. 3 qrs. 3 nls. How much was in each piece?

(2) In thirty farms there were 1630 ac. 20 po. What was the average extent of each farm?

(3) Nine loads of coals amounted to 163 cwt. 1 qr. 22 lbs. What was the average load?

(4) A farmer had a crop of 204 qrs. 1 bu. 2 pks. from 11 fields. What was the average crop of each field?

(5) A man travelled in twenty days, 325 miles 4 po. How far did he travel each day on an average, deducting the two intervening Sundays?

(6) A train of thirty-seven waggons carried 1343 cwt. 3 qrs. 16 lbs. What was the average weight in each?

(7) Find the fifty-eighth part of 554 yds. 2 qrs. 2 nls.

(8) Divide 5294 tons 7 cwt. 1 qr. into eighty-three equal portions.

(9) Required the third part of 27 yds. 2 ft. 8 in.

(10) Nineteen oxen weigh 858 st. 11 lbs. 7 oz. Find the average weight of each?

(11) Find the forty-eighth part of 1296 days 21 ho. 36 min.

(12) What is the two hundredth and first part of 3619 hrs. 0 min. 18 sec.?

(13) How long would it take to count one million two hundred and ninety-six thousand nine hundred pounds at the rate of £100 per minute?

(14) Find the number of minutes and the number of seconds in a month of four weeks.

(15) If it takes 3 yds. 2 qrs. 2 nls. to make a coat, 1 yd. 0 qrs. 2 nls. for a vest, and 3 yds. for a pair of trousers, how many suits can I get out of a piece of cloth containing 209 yds. 1 qr.?

(16) How often will a cart wheel 3 ft. 9 in. in circumference turn in going a distance of nine miles?

(17) A well nine yards deep has a wheel 3 ft. in circumference. How many turns of the wheel will raise the bucket?

(18) At a roup of growing crop a field containing 12 ac. 2 ro. 16 po. was to be divided into lots of thirty-two poles each. How many lots were there?

(19) A grocer having 1 qr. 12 lbs. 8 oz. of tea, and 7 cwts. 2 qrs. 24 lbs. of sugar, ordered his shopman to weigh all the tea into quarter pound packages, and the sugar into two pound packages. How many bags would he require for each?

(20) A farmer has a field of 13 ac. 3 ro. 14 po., and another 13 ac. 0 ro. 27 po.; he throws down the fence between them and gains 26 poles; he divides the new field into three equal portions. What is the extent of each?

(21) Shew that

$$\frac{35 \text{ ac. } 3 \text{ ro. } 19 \text{ po.} \times 47}{87} + \frac{51 \text{ ac. } 0 \text{ ro. } 21 \text{ po.} \times 47}{87} = 47 \text{ ac.}$$

(22) Shew that

$$\frac{58 \text{ cwt. } 1 \text{ qr. } 14 \text{ lbs.} \times 126}{127} + \frac{68 \text{ cwt. } 2 \text{ qrs. } 14 \text{ lbs.} \times 126}{127} = 126 \text{ cwt.}$$

(23) Shew that

$$\frac{101375 \text{ qrs } 5 \text{ bu. } 1 \text{ pk.} \times 1000}{241} + \frac{139624 \text{ qrs. } 2 \text{ bu. } 3 \text{ pks.} \times 1000}{241} = 1000 \text{ qrs.}$$

SIMPLE PROPORTION.

(1) If 3 lbs. of sugar cost 1s. 8½d. How many can I buy for 5s. 0¾d.?

(2) If 18 lbs. of rice cost 3s. 4½d. How many can be had for 13s. 6d.

(3) If 18 oz. of tobacco can be bought for 5s. 0¾d. How many can be had for £1, 5s. 3¾d.?

(4) I bought 18 articles for 8s. 5½d. How many may be had for £8, 17s. 2½d.?

(5) If 108 articles can be bought for £4, 12s. 9¾d. How many may be had for £23, 4s. 0¾d.?

(6) How many yards of cloth may be had for £16, 4s., when 12 yds. cost £3, 12s.?

(7) If I pay 8s. 8d. to go 36 miles by rail, how far may I go for £2, 5s. 6d. at the same rate?

(8) If 81 yds. Brussels carpet cost £16, 12s. 3d., how many may be had for £101, 10s. 5d.?

(9) If the rent of 14 ac. 10 po. be £54, 10s. 9d., what is the rent of 18 ac. 3 ro.?

(10) If 8 cwts. 1 qr. 15 lbs. 6 oz. cost £40, 18s. 0¾d., what will 7 cwt. 1 qr. 23 lbs. cost?

(11) If 54 tons 9 cwt. cost £412, 19s. 2d., what will 59 tons 8 cwts. cost?

(12) If 12 qrs. 5 bu. cost £59, 13s. 2d., what will 202 qrs. cost?

(13) If 6 qrs. 1 pk. cost £25, 17s. 8¾d., what will 193 qrs. cost?

(14) If 33 gals. cost £9., what will 1 gal. 1 qt. 1 pt. cost?

(15) If the rent of 207 ac. is £792, what is the rent of 2 ac. 2 ro. 14 po.?

(16) If 2 gals. 1 qt. 1 pt. cost £1, 14s. 1d., how much should I pay for 76 gals.?

(17) If 86 lbs. of tea cost £12, how much should I pay for 2 lbs. 11 oz.?

(18) If the rent of 186 ac. is £1163, 4s. 0d., what is the rent of 2 ac. 3 ro. 25 po.?

- (19) If 1 lb. 1 oz. cost £1, 10s., what will 4 dwts. 6 grs. cost?
- (20) If 5 drs. 2 scr. cost 2½d., what will 1 lb. 5 oz. cost?
- (21) If 11 cwt. 2 qrs. 11 lbs. cost £365, 2s. 9½d., what will 7 cwt. 2 qrs. 26 lbs. cost?
- (22) If 48 yds. 3 qrs. cost £200, 17s. 2½d., what will 56 yds. 3 qrs. 2 nls. cost?
- (23) If 27 cwt. 7 lbs. cost £851, 19s. 10½d., what will 7 cwts. 2 qrs. 26 lbs. cost?
- (24) If 14 lbs. 7 oz. 12 drs. cost £42, 8s. 4d., what will 21 lbs. 11 oz. 10 drs. cost?
- (25) If the carriage of 1 ton 1 qr. is £3, 0s. 9d., what should I pay for 2 cwt. 2 qrs. at the same rate?
- (26) What weight of sugar may be bought for £87, 3s. when the cost of 2 cwt. 3 qrs. 9 lbs. 13 oz. is £5, 8s. 11½d.
- (27) If the rent of 42 ac. 1 ro. 2 po. is £62, 8s. 10d., how many acres may be rented for £93, 13s. 3d.?
- (28) What quantity of wheat may be had for £22, 5s. 6d. if 27 qrs. 6 bu. 3 pks. cost £33, 8s. 3d.?
- (29) If 13 cwt. 0 qrs. 9 lbs. cost £22, 14s. 5½d., what will 20 cwt. 3 qrs. 20 lbs. cost?
- (30) If 8270 yds. 1 qr. 3 nls. cost £1650, 3s. 2½d., what should I pay for 3159 yds.?
- (31) If 15 tons 3 cwt. 3 qrs. cost £11, 8s. 9d., how much should I get for £48, 0s. 9d.?
- (32) A farmer draws a net profit of £23, 17s. 2½d. from 2 ro. 17 po. How much should he receive at the same rate from 38 ac. 3 ro. 32 po.?
- (33) If 19 cwt. 17 lbs. cost £39, 15s. 3½d., what will 1 ton 10 cwt. 2 qrs 16 lbs. cost?
- (34) If 326 yds. 3 qrs. 1 nl. cost £167, 0s. 3¾d., what will 124½ yds. cost?
- (35) If 1206 yds. 2 qrs. 1 nl. cost £240, 14s. 9½d., what will 3159 yds. cost?
- (36) If the composition of a debt of £791, 2s. 10½d. amounts to £121, 14s. 3½d., how much will be realized from a debt on the same estate of £4622, 4s. 1d.?
- (37) If the carriage of 14 tons 6 cwt. cost £13, 12s. 8d., what will the carriage of 57 tons 4 cwt. cost?
- (38) If the rent of a field containing 13 ac. 2 ro. 13½ po. be £20., how many acres can be rented at the same rate for £53, 6s. 8d.?
- (39) If the carriage of a parcel of goods containing 21 tons 9 cwt. cost £20, 9s., what will be the charge of four parcels each containing 14 tons 6 cwt.?
- (40) A field containing 58 ac. 3 ro. 18½ po. is rented at £86, 13s. 4d., how much of it should be rented for £53, 6s. 8d. at the same rate?
- (41) If the rent of 36 ac. 36 po. be 80 guineas, how many acres may be rented for £336?
- (42) What will be the price of 57 tons 4 cwt. if 150 tons 3 cwt. cost £143, 3s.?
- (43) How many acres can be rented for £126, if 90 ac. 2 ro. 10 po. are rented for two hundred guineas?
- (44) How many weeks must a labourer earning £3, 2s. 6d. in five weeks take to earn £90?
- (45) If a cistern containing 135 gals. is emptied in 15 hrs. 15 sec., in what time should one containing 567 gals. be emptied at the same rate?
- (46) What is the price of four pieces of cloth (each 216 yds.) if 4 yds. cost £2, 3s. 4¾d.?
- (47) How many acres of land would be required to graze 144 oxen if 2 ac. 2 ro. 2½ po. graze 5?
- (48) Articles which I bought for 12s. 3d. each, I sold at the rate of 14s. What was my net profit on a sale of £1400, after deducting £75, 0s. 4d. for expenses?

- (49) I bought goods at 72s. At what price must I sell them to gain 25 per cent?
- (50) I bought wheat for 50s., which I sold for 59s. What was the gain per cent?
- (51) A farmer having 8 fields containing each 47 ac. 2 ro. $7\frac{1}{2}$ po. adjoining one another, wishes to divide them into three fields of equal size instead of eight. Required the size of each?
- (52) How much sugar at $4\frac{1}{2}d.$ per lb. should I get for 3 yds. of cloth at 2s. 3d.?
- (53) If 118 tons 9 cwt. 1 qr. are carried 35 miles for £8, 16s., what weight should be carried 91 miles for the same price?
- (54) If 108 masons build a house in 96 days, how long will 72 men take to build it?
- (55) How many masons will build a wall in 18 days which occupied 27 masons 36 days?
- (56) If a garrison has provisions for 153 soldiers for 54 days, how long would they serve 459 soldiers?
- (57) I lent a friend £20, 9s. for 60 days. What sum should I get in return for 45 days?
- (58) If 54 men working 10 hours a day, finish a job in 21 days, when will 120 men do it?
- (59) A vessel with a crew of 54 men who had just been put on an allowance of 15 oz. bread daily to each man, picked up the crew of a wrecked vessel amounting to 36 persons, who shared the bread equally. What must now be the allowance so as to make it last the same time?
- (60) An estate consisting of 35183 ac. 2 ro. 5 po. was divided into 111 farms of equal size. What would be the average size of each farm if it were divided into 259 farms?
- (61) If 42 men do a job in an hour, how many men would it require to do the same in 40 minutes?
- (62) When a pole 32 ft. long cast a shadow of 72 ft., what is the height of a wall whose shadow is $20\frac{1}{2}$ ft?
- (63) A bankrupt pays his creditors 1s. 3d. per £, and pays in all £52, 6s. 8 $\frac{1}{2}d.$ What was his debt?
- (64) A bankrupt paid one of his creditors £80, 6s., which was at the rate of 13s. 4d. per £. What was the debt?
- (65) A bankrupt's debts amount to £3990, 13s. 4d. and his assets to £448, 19s. What is he able to pay in the £?
- (66) A bankrupt owes his creditors £411, 1s. 10 $\frac{1}{2}d.$ and his assets are £41, 2s. 2 $\frac{1}{2}d.$ How much must the creditors lose per £?
- (67) A bankrupt's estate is worth 3s. 9d. in the £. How much should a creditor receive whose claim is £339, 6s. 8d.?
- (68) A creditor's claim on a bankrupt estate is £6616, 4s., and he receives £1240, 10s. 9d. At what rate is that per £?
- (69) A bankrupt's debts amount to £6760, 4s. 2d., and his assets are £1883, 15s. 4 $\frac{1}{2}d.$, but £362, 14s. 5 $\frac{1}{2}d.$ of which are bad debts. How much is he able to pay in the £?
- (70) A creditor for a debt of £1745, 7s. 6d. receives £392, 14s. 2 $\frac{1}{2}d.$ What is the debt of another creditor on the same estate who receives £115, 9s. 0 $\frac{1}{2}d.$?
- (71) If £23, 17s. 2 $\frac{1}{2}d.$ gain £2 of interest in 8 months, what sum will gain the same interest in 3 months?





